University of London, Galton Laboratory, University College

GALTON LABORATORY MEMOIRS, XXXVI

RACE CROSSING IN MAN

The Analysis of Metrical Characters

J. C. TREVOR
B.Sc., M.A., Ph.D.
Lecturer in Anthropology in the University of Cambridge

WITH A PLATE & ONE TEXT-FIGURE

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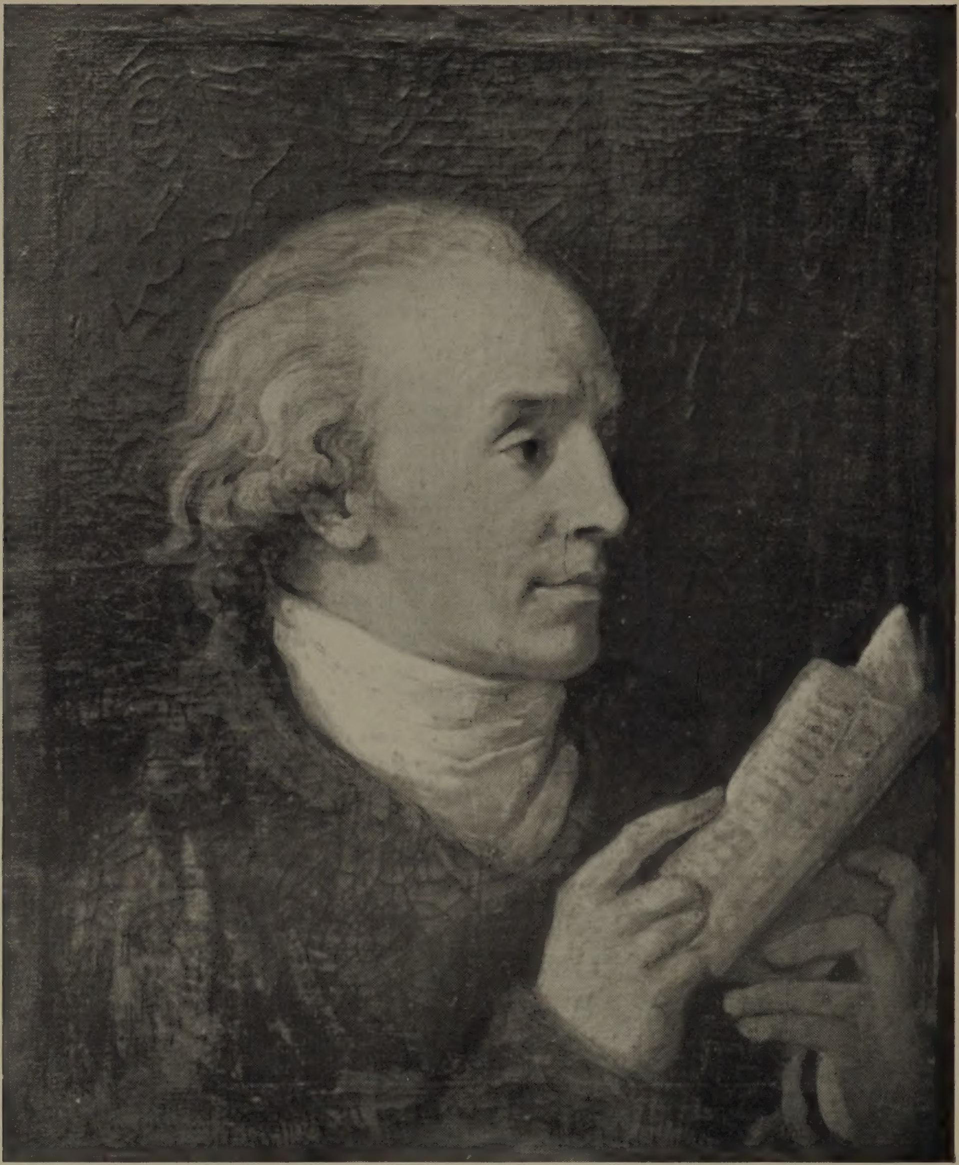

J. F. BLUMENBACH

(from a portrait attributed to W. Tischbein, 1751–1829, by kind permission of
Landgerichtsdirektor Felix Blumenbach of Celle, Blumenbach's great-grandson)

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To the Memory of

JOHANN FRIEDRICH BLUMENBACH

ANTHROPOLOGIST AND PHILANTHROPIST

11 *May* 1752 – 22 *January* 1840

Es gibt nur eine Gattung (*species*) im Menschengeschlecht; und alle uns bekannte Völker aller Zeiten und aller Himmelsstrichte können von einer gemeinschaftlichen Stammrasse abstammen. Alle National-Verschiedenheiten in Bildung und Farbe des menschlichen Körpers sind um nichts auffallender oder unbegreiflicher als die, worin so viele andere Gattungen von organisirten Körpern, zumahl unter den Hausthieren, gleichsam unter unsern Augen ausarten. Alle diese Verschiedenheiten fliessen aber durch so mancherlei Abstufungen und Uebergänge so unvermerkt zusammen, dass sich daher auch keine andere, als sehr willkürliche Gränzen zwischen ihnen festsetzen lassen.

[There is but one species of mankind; and all people of all times and of all regions known to us can spring from one common original stock. All national variations in form and colour of the human body are not more striking or incomprehensible than those into which so many other kinds of organisms, especially among domestic animals, are, as it were, transformed before our eyes. Yet all these differences flow so imperceptibly together, through so many gradations and transitions, that only very arbitrary limits may be set between them.]

Handbuch der Naturgeschichte, 12. Ausg., 1830, S. 55–6.

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PREFATORY NOTE

In recent years the emphasis of researches in physical anthropology has been on the study of the distributions of the blood antigens. The ascertainment of frequencies of genetically determined diseases in different populations is also beginning to attract attention. There still remains nevertheless a great deal to be learnt about the distribution of the visible and metrical features of mankind in different parts of the world. Measurements, such as stature, or head length, are not as directly controlled by genes as are the blood antigens or biochemical specificities. Though basically determined by a multiplicity of genes, they are also influenced by environment. Thus, metrical physical differences between tribes or populations cannot always be assumed to be genetical in origin. Dr Trevor's work, which was carried out in the Galton Laboratory under Dr G. M. Morant, deals with metrical characters and forms the subject of a monograph which will help to redress the balance of emphasis in favour of the study of visible physical traits.

The investigation and evaluation of the results of matings between previously long-isolated human populations, often called (inaccurately as I believe) race crossing, has fascinated anthropologists and sociologists. It has also provided a field for philosophical speculation sometimes directed towards political ends. The collection of facts has often lagged far behind the propagation of theories. In spite of the genetically unpromising nature of the measurements recorded, Dr Trevor has succeeded in making an important contribution to knowledge in this field by carefully sifting the existing data and adding some of his own observations where necessary to complete the picture.

The effects of mixing populations, with different initial frequency distributions of blood-group genes, has long ago been studied in the Hungarian gypsies and in the hybrids between Europeans and North American Indians. The resulting frequencies in the hybrid populations are intermediate between those in the parent populations. For visible metrical characters, determined by a multiplicity of genes, the result of a similar process would be to produce a new population intermediate in its mean measurements between those of the originals. This is indeed exactly what Dr Trevor finds to be the case in almost all of the instances he examines. He has been able further to demonstrate that many earlier speculations about the supposedly peculiar effects of racial mixture are quite unfounded.

The publication of Dr Trevor's monograph was delayed by the second world war, but it summarizes information which can never be out of date. As a contribution both to human genetics and to physical anthropology it falls naturally into place as a Eugenics Laboratory Memoir. This series, which contains all the volumes of the *Treasury of Human Inheritance* as well as a variety of monographs, was started by Karl Pearson in 1907 and has been continued ever since.

April 1952 L.S.P.

RACE CROSSING IN MAN

The Analysis of Metrical Characters

I. INTRODUCTION

Some features of the subject under review were briefly discussed in a paper which appeared a year before the outbreak of war (Trevor, 1938). It was the writer's original intention to incorporate the evidence for the statements then made in a general monograph on the biological and social effects of race crossing. Absence on active service abroad during the period of hostilities, however, and subsequent demands on his time by academic duties, have seriously hampered the attainment of such an object. To avoid further delay, it seems desirable that different aspects of the problem with which he has been occupied should receive separate treatment, and the present study concerns the first of these. Research on it was carried out in the Galton Laboratory between 1936 and 1938 during the tenure of a Leonard Darwin Fellowship awarded by the Eugenics Society. The writer wishes to record his gratitude to the Society for its financial support; to Dr G. M. Morant, under whose direction he worked and to whom he owes more than can be expressed in any formal acknowledgement; and to Professors Sir Ronald Fisher, F.R.S., and J. B. S. Haldane, F.R.S., for much helpful discussion. He is further indebted to the late Dr Maurice Newfield, Editor of the *Eugenics Review*, for leave to reproduce the text-figure and certain passages from the paper already referred to, which was published in that journal; to his former teachers, Miss B. M. Blackwood and the late Dr L. H. Dudley Buxton of Oxford, and to Professor Frederick S. Hulse of Seattle and Dr L. H. Wells of Edinburgh for the use of unpublished data; to Professor L. S. Penrose for his interest in the present memoir, which he has taken the initiative to include in the Eugenics Laboratory series, and for his prefatory note; to Dr Julia Bell and Miss Mary N. Karn for criticism of the text; to Miss H. Lang Brown for typing and improving the manuscript; to Miss C. Schwenz for assistance in translation; and to Professors Eugen Fischer, R. Ruggles Gates, F.R.S., Corrado Gini, Melville J. Herskovits, Earnest Hooton, William Howells, Julian Huxley, F.R.S., J. A. Keen, R. Kherumian, Clyde Kluckhohn, P. C. Mahalanobis, F.R.S., H. J. Muller, Leonhard Schultze, H. L. Shapiro and H. V. Vallois for advice on various points and for the provision of literature.

This study relates to anthropological measurements of living people, characters which display continuous variation and are susceptible of biometric rather than strictly Mendelian analysis, although their genetical basis is now known to be the same as that of characters showing discontinuous variation (Mather, 1949). The anthropologist is concerned more with groups than with individuals. He regards the situation confronting him in its descriptive aspects and, to start with at least, he may hold no theory as to the mechanism of inheritance of physical characters. The position of the geneticist is usually somewhat different. His chief interest lies in the mode of individual inheritance, and the material he considers first will consist of separate family lines, so that the samples with which he is accustomed to deal are often small when compared with those treated by the anthropologist. It is thus possible that an adequate knowledge of the characters displayed by 'hybrid' *groups* may not throw any clear light on the question of heredity in racially mixed *individuals*. But the assumption is frequently made that a knowledge of the mechanism of inheritance in particular family lines also justifies its prediction for a population comprising a large number of such family lines. The validity of this view will differ in the case of the more familiar of the blood-group systems, where the mode of individual inheritance is relatively simple, and in that of anthropometric characters (measurements of the body and its segments, of the head, and so on), which are decidedly more complex owing to their multifactorial nature.

In spite of the distinction just made between the standpoints of the anthropologist and the geneticist, it should be realized that they are to some degree complementary, and that if it is impossible to reconcile their findings, this must be due to erroneous deductions from the material of one or of the other. The anthropologist has in mind the situation as it actually exists, and his data are seldom of a simple nature or such that the information he would like concerning them is in any way complete. When there has been crossing between two groups representing racially distinct human populations, the conditions under which it has taken place are always very different from any ideally controlled experiments arranged by the laboratory geneticist who works with non-human material. For example, the original numbers of each race that has contributed to the ancestry of a particular hybrid sample may have been markedly unequal, and are usually quite unknown. It is only in exceptional instances that their respective proportions can be inferred, as in that of the mutineers of H.M.S. *Bounty* and the Polynesian women with whom they mated. In general, all that can be stated with certainty about a hybrid group is that it has been derived from at least two races; but the respective contributions each has made to it may be a matter of the vaguest conjecture. Again, at any time it may include individuals who represent almost every grade of intermixture; and there is seldom reason to suppose that it has remained isolated without back-crossing to one or both of the parental populations or even being affected by exposure to fresh influences. Such hybrid communities are therefore most involved in their biological constituents; yet they are the ones that do in fact occur, and it is necessary to study them in order to reach conclusions of practical value.

A great deal of confusion has been caused by failure to appreciate the difference between the group and the individual situations. One of the main tasks of the anthropologist is to trace the descent of human groups, and the problem of their intermixture is of special importance to him because a knowledge of its consequences must be obtained before he can hope to construct his racial genealogies. As a rule, anthropologists have taken more or less for granted certain generalizations bearing on the effects of race crossing. For example, it is often supposed that when two populations have crossed to form a third, the average values of the physical characters of this last will be intermediate in relation to those of its progenitors. The fact that in this case the anthropologist is thinking of an amalgamation of *group* characteristics is generally overlooked and has given rise to much unprofitable discussion of 'blending inheritance'. An opinion also widely held is that the crossing of markedly distinct races will result in a population that displays a high degree of variability and that the frequency distribution curves of its metrical characters will in turn be of an unusual kind, possessing more than a single mode or peak.

Such inferences are of prime anthropological importance, and it is rather surprising that no comprehensive examination of the material that is most suitable for testing their validity, namely, that furnished by the intermixture of groups representing appreciably different human physical types, has so far been made. They have, it is true, been considered empirically in the case of particular studies of hybrid communities, but often with discordant results. Extreme types can be chosen deliberately, because it seems safe to infer that they are likely to provide the best evidence that is required to throw light upon the general problem. It is not of course suggested that the nature of the mechanism of inheritance will be different, say, when a group of European origin is crossed with a Negro one, and when the cross occurs between two racially dissimilar European groups.

Several hybrid communities have been investigated anthropologically within the past sixty years, but the information presented by many of the observers is quite inadequate for the demands of a quantitative survey. In the present instance it has been possible to select nine studies—two of crosses between Europeans and Negroes, three of crosses between Europeans and American Indians, and four of crosses between Europeans and other non-European groups—which afford a more or less satisfactory basis for certain preliminary conclusions that may be drawn from the measurements of living subjects.

For the kind of treatment attempted, there is need of data that relate not only to the hybrid group itself but also to both its parental populations. It must be acknowledged that, for practical purposes, there are no measurements whatever for the actual parental groups from which the hybrids were derived. In the case of the different hybrid series that will be analysed, the process of intermixture has been of varying duration and has taken place within a period that extended, as far as is known, from the beginning of the sixteenth century onwards. The earliest of the series was not investigated until 1893, by which date it is probable that all the parents of wholly European or non-European origin who participated in the initial cross had died. What can be obtained, and what have been used for comparative purposes, are measurements of groups believed to be descended from the populations of which the parents formed part. It is necessary to appreciate the point just made because an appraisal of the situation becomes much more difficult if the parental populations were themselves changing phenotypically in the course of the period mentioned. As far as metrical characters are concerned, there is no good evidence to show whether appreciable changes occurred in them or not, and it is evident that the best comparisons possible are far from ideal. A further danger is that the parents of the hybrids may not have been truly random samples of the populations to which they themselves belonged.

The nine hybrid series to which reference has been made will be described later, but some of their features deserve comment here. It is highly probable that in the initial cross most of the fathers were Europeans and the mothers non-Europeans, but a few European women may have intermarried with the hybrids in later generations. On the whole, it will be convenient to assume that the immediate ancestors of the first generation were exclusively European males and non-European females. It is unfortunate that there are no data relating to the sort of first filial generation considered by geneticists in the case of any of the series dealt with, and it can only be supposed that each of them has been made up of individuals whose pedigrees represent, contemporaneously, varying grades of intermixture. In general, there is no information regarding the degree of genealogical heterogeneity shown by a particular series, but two instances exist in which either the conditions of the formation of the cross were different from those of the rest or for which some details of the kind indicated are available.

As has already been pointed out, the descendants of the *Bounty* mutineers are in certain respects unique. It is known that they are mainly derived from a few primary crosses between Englishmen and Tahitian women. Their pedigrees are thus approximately of the same length, and each subject may be regarded as the product of equal amounts of European and non-European ancestry, provided that such factors as selective mating or differential death-rates can be overlooked. By reason of their geographical isolation, the inhabitants of Pitcairn and Norfolk have formed practically a closed community, and the prolonged inbreeding which has occurred on these two islands takes on the aspect of an unpremeditated biological experiment. There is little doubt that several back-crosses to the parental populations are represented in the eight other hybrid groups, none of which has been isolated to the same extent as the Pitcairn and Norfolk Islanders. Some investigation of pedigrees was undertaken in five studies, and attempts were made to construct subseries containing different proportions of intermixture between the parental groups. Owing to the small size of most of these subseries, it is not profitable to consider them separately for the purpose of analysis, except in a single case, that of the hybrid American Negroes. All the remaining series, then, comprise agglomerations of individuals with unequal 'mixed' pedigrees and possessing various proportions of the two main ancestral races.

As far as can be ascertained, and with an exception which will now be mentioned, each hybrid population treated appears to have been derived from purely European sources, on one side, and a single non-European stock, on the other. In his extensive work on the American Negro, Herskovits (1930) has described a number of hybrid series into the composition of which European, Negro and American Indian elements have entered. These are not large, however, and on this account and because an adequate treatment of them would be an extremely complicated undertaking, they have been omitted from the present discussion.

While little difficulty exists in selecting the hybrid series for consideration, the task of obtaining samples which can fairly be supposed to represent the parental groups is far from easy. All that it seems possible to accomplish in such a direction is to find modern series which may be presumed suitable for the purpose in view if the characters used are not subject to secular change. As an illustration, the type of the half-dozen Englishmen who founded families on Pitcairn Island at the close of the eighteenth century is, for eleven of the fourteen characters compared, taken to be the same as that of a series of Oxfordshire villagers measured in 1922 and 1923. In this case it is possible that the two groups, supposed to be equivalent, constituted samples, of a not absolutely random nature, of populations which were somewhat different in type. The ten or twelve Tahitian women with whom the *Bounty* mutineers contracted unions are in turn represented by a series drawn from the contemporary population of the whole of the Society Islands. The best comparisons which can be made in such circumstances are evidently very imperfect. In dealing with other hybrid series, the conditions are no better. The method employed has been to select samples which appear to give more or less satisfactory representations of the parental groups involved in the formation of the hybrid population and to make comparisons within these triads. At first sight it seemed quite probable that the material would be too defective to yield conclusions of any value. Actually, those arrived at are so consistent that it can be safely assumed that its manifest defects are of less consequence than was feared.

Any adequate statistical characterization of a population demands a sample of sufficient size to furnish reliable constants. It is known from anthropological experience that small samples, composed of fewer than thirty individuals, normally provide either misleading or inconclusive results. There is also some danger that small samples are less likely to have been selected at random from the assemblies they are supposed to characterize than large ones. Again, the numbers of observations recorded for different characters in one sample is seldom constant. In the hybrid series now considered, they range from 880 to 23 in the case of adult males and from 72 to 39 in that of adult females, the majority for adults of both sexes being over 50. Most of these numbers are by no means large for statistical purposes, but the series are the longest available. The samples chosen to represent the parental groups vary in numbers of observations for different characters from 5426 to 24 and from 1549 to 25 in the case of males and females respectively.* On the whole they are larger than those for the hybrid series, but it is evident that ideal statistical requirements are satisfied very imperfectly by the data used.

Owing to the influence of the factor of personal equation in metrical descriptions of living subjects, it would have been a decided advantage if each triad—the hybrid and the two parental series—had been measured by the same observer. This has been done in only two studies. In others the hybrid and one parental series have been measured either by a single observer or by a small group of observers working in conjunction, and in the rest each one of the three associated series has been described by a different observer. It is well known that comparisons between measurements recorded by several observers working independently will often differ on the average to such an extent that true racial distinctions are entirely obscured, merely on account of the way in which the measurements were taken. This is a regrettable state of affairs, but one which cannot be avoided until anthropometric techniques become more rigorously standardized than they are at present. It may be supposed that exact comparisons can be made between data collected for various series by the same observer or by a number of observers working together. In other cases the position is different for different characters. There may be little danger in comparing statures and cephalic indices recorded by independent observers, but nearly all the measurements of the face and the limbs are less reliable. So far as the present material is concerned, an attempt has been made to compare as many characters as could be secured with any reasonable expectation of accuracy, although such a procedure involves retaining some comparisons which are quite likely to be fallacious owing to 'errors' of measurement.

Some idea of the limitations imposed on the investigator in his treatment of anthropometric material has been given in the preceding paragraphs, but it is again necessary to stress the fact that comparison of data recorded by different observers working independently is often a hazardous undertaking. In the following sections an attempt will be made to compare as many characters as are available for certain adequately studied crossed populations with their diverse parental groups by simple statistical methods. In a few cases it has been necessary to exclude certain characters where it was felt that the constants were unreliable on account of the large personal equation involved in taking the original measurements and of the inclusion of immature individuals in a professedly 'adult' series. These are elementary precautions, but none the less essential in view of the frequency with which they come to be omitted. Probably a safe procedure is to take twenty years as the *terminus a quo* for maturity, although the inclusion of a small percentage of subjects below this age in some series cannot always be avoided. The selection of the presumed parental groups with which to compare the hybrids is a difficult matter. Where several different racial elements are known to have entered into the composition of the latter, the choice becomes even more involved. It is, indeed, far from simple when the racial antecedents of a particular parental group are fairly well known but information as to the social class that participated in the formation of the cross is wanting. Fortunately, in the kind of comparison involved the respective parental groups are as a rule sufficiently differentiated to make this disadvantage of less importance than would be the case in comparing more closely related series.

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* Whenever possible the most substantial samples have been used for such a purpose. It was not until the present study had gone to press that the writer became aware of the existence of the measurements on 200 Mayas published by the late Dr Morris Steggerda in 1941. As can be seen from the male mean values given in a footnote to Table 8 (p. 18), this series accords well with Steggerda's earlier but smaller one of the same people.

The ideal method of treating the crossed population would be to secure a number of subseries representing different degrees of admixture, to distinguish between the first and the subsequent filial generations and between these and back-crosses to one or other of the parental groups. This is feasible only if sufficient genealogical evidence is available or can safely be inferred. So far as it is possible to ascertain, all the mixed series to be considered are of, or later than, the second filial generation, although it is likely that a sensible proportion of back-crosses is included in most of them. When the mixed series is numerically small, the effect of a genealogical division usually rules an adequate statistical analysis out of the question; and in such circumstances it has been necessary to pool the observations and to regard the mixed series as a whole.

The essential treatment consists in a comparison of the mean or average values of the anthropometric characters of the hybrid series (H) with those of the two groups, non-European (N) and European (E), from which they are supposed to originate. The order of magnitude of the means is first considered, and the relation of the hybrids to the parental groups is then set out, in the form of a table. But this may be quite misleading unless it is accompanied by some idea of how far differences between the mean values may be due to chance, an indication of which is given by the standard error of the mean of each character. The standard error is influenced by two factors, the number and the distribution of the individual measurements from which the mean is calculated. An estimate of the distribution or dispersion of the individual measurements of a character about its mean can be furnished by the standard deviation. The standard error of the mean, e, is determined by the formula $s/\sqrt{n}$, where s is the standard deviation of the sample and n the number of observations recorded for a particular character. Whether the difference between a pair of means is real or 'significant' and not simply due to errors of random sampling is ascertained by dividing it by its standard error. Thus, when d is the difference between two means and e_1 and e_2 are their respective standard errors, the standard error of the difference will be $\sqrt{(e_1^2+e_2^2)}$. An arbitrary criterion may then be set up to decide whether it is as likely as not to be due to chance. In the present case if a difference is less than twice its standard error it is assumed to be insignificant, that is, where $d/\sqrt{(e_1^2+e_2^2)} \geqslant 2$, the odds against its being due to chance selection from an infinitely greater number of observations than are actually available are as 22 to 1. By adding to the table of means a further table of significant differences in terms of their standard errors, a measure of the extent to which these differences are of real import is obtained.

Such a treatment naturally calls for the presentation of original data in a form in which the requirements of the analysis outlined above can be satisfied. Unfortunately, in many instances anthropologists have been content either to give means of characters without their individual values or any distributions from which the standard deviations could be found or to provide these for some characters and not for others, thus considerably reducing the scope of the analysis.

Comparisons of the kind indicated are admittedly very crude and may be misleading. If for a particular character there is, in fact, no distinction between the true means of the parental series, then the question whether the mean of a sample drawn from the first population is greater or less than the mean of a sample drawn from the second population will be determined merely by chance. In such a case, the further question whether the mean of the sample drawn from the hybrid population falls between the two parental means will also be expected to be determined by chance; hence no significance can be attached to the order in which the series are arranged by their several means. Where, however, the means of the parental series are widely different, the position of the corresponding mean of the hybrid series in relation to them is of real significance, and, as might be expected on a polymeric hypothesis, its value will tend to approach that of the parental group which has made the greater contribution to it. A rather striking example of this is provided by the changes in position of the mean value of the nasal breadth in Herskovits's male American Negroes, illustrated in Fig. 1, where there is a progressive decrease in the direction of the narrower European nose with increasing amounts of White ancestry.

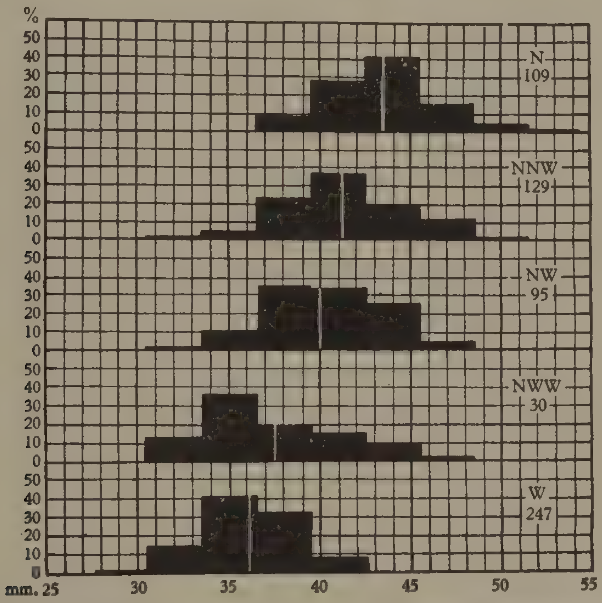

Fig. 1. Changes in the male mean value of the nasal breadth with increasing amounts of European ancestry in three series of hybrid American Negroes*

II. HYBRID AMERICAN NEGROES

One of the most detailed anthropological studies of a hybrid population yet made is that of Herskovits (1930). In it the records of five observers are combined to form adult male and female 'American Negro' samples of considerable size, due precaution being taken to exclude any data which could not be regarded as comparable owing to differences in the technique of measurement. Genealogies are given for 1551 of 1893 subjects of both sexes, and of these only

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* The vertical white line in the body of each histogram represents the position of the mean. The interpretation of the symbols used is as follows: N unmixed Negro, NNW more Negro ancestry than White, NW approximately equal amounts of Negro and White ancestry, NWW more White ancestry than Negro, W 'Old American' White. The figures below a symbol denote the number of individuals represented. The negative skewness of the NWW distribution is almost certainly due to the small size of the sample. (Compiled from Herskovits, 1930, and Hrdlička, 1925.)

22 % claimed to be wholly of Negro extraction, while 26·5 % returned themselves as possessing some degree of American Indian ancestry.

The involved nature of the total samples, composed as they are of the descendants of African Negroes, European Whites and American Indians in varying proportions, does not suggest that a detailed comparison of the mean values for metrical characters would serve any useful purpose in an attempted assessment of the physical effects of race crossing. Fortunately, however, Herskovits also devoted much labour to establishing the validity of the genealogies of a male series he himself measured, partly in the Harlem District of New York but principally at Howard University, Washington, D.C. This 'Howard University Series', which will now be considered, is divided by Herskovits into eight subseries, according to the approximate amount of Negro-White and Negro-White-Indian ancestry in each. It is not only representative of the Negro population of the United States as a whole, but also includes a certain proportion of subjects from the West Indies and British Guiana.* Details of the racial composition of the Howard University Series are given in Table 1.

TABLE 1. *Howard University series of male American Negroes*

Ancestry	Size of subseries	Percentage of total
N = unmixed Negro	109	20·3
N (I) = unmixed Negro with Indian	36	6·7
NNW = more Negro than White	129	23·8
NNW (I) = more Negro than White with Indian	51	9·6
NW = about the same amount of Negro and White	95	17·7
NW (I) = about the same amount of Negro and White with Indian	57	10·6
NWW = more White than Negro	30	5·6
NWW (I) = more White than Negro with Indian	31	5·7
Totals	538	100·0

The introduction of the Indians is a complicating factor with which it is rather difficult to deal, both on account of the scarcity of comparative material relating to the Indian peoples with whom the Negroes may be supposed to have mixed most, and also because an invidious value is attached to the possession of Indian ancestors among American Negroes. Herskovits observes that 'it may well be that statements as to the presence of this element in one's ancestry are something in the nature of family tradition without too secure a basis in fact'. In the present analysis, consideration is restricted to the N, NNW, NW and NWW subseries in which no admixture with Indians is known. The White group, W, used for comparison is that of the 'Old Americans' studied by Hrdlička (1925) and comprising subjects whose parents and grandparents, at least, were all born in the United States. It must of course be remembered, as Herskovits is careful to insist, that the Old Americans are not necessarily identical with the European ancestors of the Negro-White hybrids.

A caution should be added with regard to the 'adultness' of the Howard University sample as a whole. Of the individuals composing it, some 88 % are of or over 20 years of age while slightly less than 1 % are under 18. On the assumption that those under 20 are distributed at random among the eight subseries it does not seem likely that any of the means will be appreciably affected owing to the inclusion of immature individuals.*

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* It should be recollected that in North America as a whole the term 'Negro' is very loosely used and may embrace individuals possessing only a remote trace of African ancestry.

Twelve characters common to the various American Negro subseries and to the Old Americans can be compared, but it is probable that three of these, ear length, ear breadth and mouth width, have not been taken in the same way, as their definitions given by Herskovits and Hrdlička are somewhat at variance. Mean measurements and standard errors of the N, NNW, NW, NWW and W groups are given in Table 2, which should be considered in conjunction with Table 3, i.e. that of differences between the means in terms of their standard errors, or 'critical ratios'.

TABLE 2. *Means of male American Negroes and Old American Whites*†

Character	Means and standard errors				
	N	NNW	NW	NWW	W
Stature	170·4 ± 0·56 (102)	170·4 ± 0·63 (115)	171·7 ± 0·64 (87)	172·2 ± 1·47 (23)	174·3 ± 0·22 (727)
Head length	198·0 ± 0·63 (109)	196·9 ± 0·62 (129)	196·1 ± 0·66 (95)	195·9 ± 1·27 (30)	197·1 ± 0·22 (727)
Head breadth	151·9 ± 0·50 (109)	151·7 ± 0·57 (129)	151·4 ± 0·49 (95)	153·2 ± 1·23 (30)	153·9 ± 0·19 (727)
Minimum frontal breadth‡	107·2 ± 0·40 (108)	106·6 ± 0·45 (129)	106·0 ± 0·44 (94)	105·7 ± 0·80 (30)	105·9 ± 0·27 (247)
Bizygomatic breadth	140·7 ± 0·52 (108)	138·4 ± 0·60 (129)	139·0 ± 0·62 (95)	137·3 ± 1·31 (30)	138·6 ± 0·31 (247)
Facial height	123·9 ± 0·54 (108)	122·7 ± 0·55 (127)	122·6 ± 0·62 (95)	120·1 + 1·08 (30)	119·3 ± 0·43 (247)
Nasal height	53·1 ± 0·30 (109)	53·3 ± 0·33 (129)	53·7 ± 0·33 (95)	53·7 ± 0·63 (30)	53·5 ± 0·21 (247)
Nasal breadth	43·4 ± 0·27 (109)	41·3 ± 0·30 (129)	40·0 ± 0·31 (95)	37·5 ± 0·70 (30)	36·1 ± 0·16 (247)
Ear length	59·8 ± 0·44 (108)	59·7 ± 0·35 (129)	60·9 ± 0·39 (94)	60·4 ± 0·63 (30)	66·9 ± 0·30 (247)
Ear breadth	33·8 ± 0·31 (108)	33·2 ± 0·23 (129)	33·1 ± 0·27 (95)	32·7 ± 0·38 (30)	37·9 ± 0·16 (247)
Mouth width	55·0 ± 0·36 (107)	52·9 ± 0·38 (126)	52·4 ± 0·33 (95)	52·1 ± 0·63 (30)	53·7 ± 0·24 (247)
Cephalic index	76·9 ± 0·31 (109)	77·1 ± 0·33 (129)	77·2 ± 0·30 (95)	78·3 ± 0·65 (30)	77·9 ± 0·11 (727)

As the groups are arranged in Table 2 they show a gradual transition from the unmixed Negroes at one end to the unmixed Whites at the other, the amounts of Negro and White ancestry respectively decreasing and increasing from left to right. The NNW's, comprising subjects who claim more Negro ancestry than White, fall somewhere between the N's and NW's, although not necessarily equidistant from these. Similarly, the exact position of the NWW's relative to the W's and NW's must be considered uncertain. Table 3 is so arranged that the pairs which might be expected to show the closest resemblance are given first, followed by pairs expected to be less alike until, at the other extreme, the most divergent comparison, namely, that between the groups representing two presumed parental populations, is made. In asking whether there is a relation between this order and the numbers of significant differences found in the various comparisons, the fact should not be forgotten that the samples are of different sizes. Where there is a real distinction between the means, comparisons with the largest series, in the present case the W, will tend in general to show a greater number of significant differences and high values of the ratio merely on account of its size, comparisons with the smallest one, the NWW, showing on expectation a small number of significant differences and low values of the ratio for the same reason. If the disparity in sizes is allowed for, the numbers of significant differences increase as regularly as could have been anticipated on proceeding from the left-hand to the right-hand column of Table 3. The groups that are contiguous in Table 2 are found to be least differentiated, and those representing the parental populations appear to exhibit the greatest divergence, although a perfect uniformity of the kind considered does not occur. For example, the comparison between the W's and NW's would be expected to show fewer significant differences than that between the W's and NNW's, yet the reverse is actually observed. But little weight need be given to unexpected relationships of this nature.

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* In any case it would appear from the numbers of observations on which the means are based that all or nearly all subjects under 20 were omitted in computing the means for stature, although not those for measurements of the head.

† The units in this and the succeeding tables are centimetres for stature, sitting height and span, and millimetres for the rest of the absolute measurements. The figures in parentheses after a mean denote the number of observations on which it is based. The Old American (W) means for stature, head length, head breadth and cephalic index are those of Hrdlička's total male sample. For the other characters they are taken from his Laboratory Series, composed of subjects from all parts of the United States, the north preponderating. The standard errors, with the exception of those for minimum frontal breadth of the N and NW subseries (see following footnote), were found from the standard deviations provided by Hrdlička (1925) and Herskovits (1930).

‡ Herskovits's distributions include two exceptionally high values for minimum frontal breadth, viz. one of 147 mm. in the N and another of 141 mm. in the NW subseries. As these are sensibly removed from the general ranges, there is reason to believe that they have been mistakenly copied, and it has been thought advisable to omit them and to calculate the N and NW means and standard deviations for this character afresh.

The data in Table 3 show which characters may be considered undifferentiated for all the groups as far as can be ascertained from the evidence that is available. The nasal height is evidently of such a kind, and the head length may be classed with it, since no importance can be attached to a single difference found in a set of ten comparisons which might be thought significant if considered alone. In the case of these two characters, the orders in which the means arrange the groups are not of any moment. The remaining ten characters show some differences which indicate clear differentiation of the means for two or more pairs of the populations sampled. For stature, nasal breadth and facial height the means present a regular gradation from the N's at the one extreme to the W's at the other, a situation which is illustrated diagrammatically in the case of nasal breadth in Fig. 1. As far as the rest of the nine characters are concerned, such a regular gradation is not in fact present, although for most of these the same order can be obtained by transposing one or two pairs of means which differ insignificantly from each other. This is so for head breadth, minimum frontal breadth, ear length and cephalic index. To take head breadth as an illustration, the groups N, NNW and NW do not give the order expected, but the differences between the means of this character are quite insignificant in all three groups, so the fact that they show a departure from the regular gradation may well be due to chance. The same suggestion cannot be offered in the case of ear breadth and mouth width. For both of these, however, the first four groups, N, NNW, NW and NWW, show a perfect gradation according to expectancy, and only the fifth, W, deviates from it. But of all twelve characters, ear breadth and mouth width are the two most likely to be taken in different ways when the technique of more than a single observer is involved, and the four Negro groups were measured by one anthropologist, while the White series formed the subject of an independent investigation by another. If the aberrant results found for the exceptions are indeed due to discrepancies in method, then the comparison as a whole suggests strikingly that there is a tendency for the average measurements of a hybrid population to approach the values of the stock which has made the greater contribution to its ancestry.

TABLE 3. *Differences between means of male American Negroes and Old American Whites expressed as critical ratios*

Character	Expected relation of pairs of groups									
	Closest				Somewhat removed			Further removed		Furthest removed
	N and NNW	W and NWW	NW and NNW	NW and NWW	N and NW	W and NW	NNW and NWW	N and NWW	W and NNW	N and W
Stature	—	—	—	—	—	3·8	—	—	5·9	6·5
Head length	—	—	—	—	2·1	—	—	—	—	—
Head breadth	—	—	—	—	—	4·8	—	—	3·7	3·7
Minimum frontal breadth	—	—	—	—	2·0	—	—	—	—	2·7
Bizygomatic breadth	2·9	—	—	—	2·1	—	—	2·4	—	3·5
Facial height	—	—	—	2·0	—	4·4	2·1	3·1	4·9	6·7
Nasal height	—	—	—	—	—	—	—	—	—	—
Nasal breadth	5·2	—	3·0	3·3	8·3	11·2	5·0	7·9	15·3	23·3
Ear length	—	9·0	2·3	—	—	11·3	—	—	14·3	12·5
Ear breadth	—	12·6	—	—	—	15·3	—	2·2	16·8	11·8
Mouth width	4·0	2·4	—	—	5·3	3·2	—	3·9	—	3·1
Cephalic index	—	—	—	—	—	2·2	—	—	2·3	3·0

TABLE 4. *Comparison of means of male unmixed and hybrid American Negroes and Old American Whites**

Character	Means and standard errors			Critical ratios		
	Unmixed Negroes (N)	Hybrid Negroes (H)	Whites (E)	N and H	H and E	N and E
Stature	170·4 ± 0·56 (102)	171·1 ± 0·43 (225)	174·3 ± 0·22 (727)	—	6·6	6·5
Head length	198·0 ± 0·63 (109)	196·5 ± 0·30 (254)	197·1 ± 0·22 (727)	2·1	—	—
Head breadth	151·9 ± 0·50 (109)	151·7 ± 0·26 (254)	153·9 ± 0·19 (727)	—	6·8	3·7
Minimum frontal breadth	107·2 ± 0·40 (108)	106·2 ± 0·21 (253)	105·9 ± 0·27 (247)	2·2	—	2·7
Facial height	123·9 ± 0·54 (108)	122·3 ± 0·26 (252)	119·3 ± 0·43 (247)	2·7	6·0	6·7
Bizygomatic breadth	140·7 ± 0·52 (108)	138·6 ± 0·29 (254)	138·6 ± 0·31 (247)	3·5	—	3·5
Nasal height	53·1 ± 0·30 (109)	53·6 ± 0·15 (254)	53·5 ± 0·21 (247)	—	—	—
Nasal breadth	43·4 ± 0·27 (109)	40·4 ± 0·16 (254)	36·1 ± 0·16 (247)	9·6	19·0	23·3
Ear length	59·8 ± 0·44 (108)	60·3 ± 0·17 (253)	66·9 ± 0·36 (247)	—	16·6	12·5
Ear breadth	33·8 ± 0·31 (108)	33·2 ± 0·11 (254)	37·9 ± 0·16 (247)	—	24·2	11·8
Mouth width	55·0 ± 0·36 (107)	52·6 ± 0·17 (251)	53·7 ± 0·24 (247)	6·0	3·7	3·1
Cephalic index	76·9 ± 0·31 (109)	77·3 ± 0·15 (254)	77·9 ± 0·11 (727)	—	3·2	3·0

It is of interest, however, to examine the characters of the hybrid Negroes in the Howard University series as a whole and to compare them with those of the unmixed Negroes and Hrdlička's Old Americans. Herskovits has not provided figures for a sample of this nature, but they can be obtained from the distributions of his NNW's, NW's and NWW's, and the means so found are given in Table 4, in which the corresponding values of the N subseries and the Old Americans are repeated. It is evident from the relative sizes of the NNW, NW and NWW groups that the hybrid one formed from them will contain a preponderance of Negro ancestry. Twelve characters are considered as before, but of these ear length, ear breadth and mouth width may be disregarded since differences in definition or 'errors' in personal equation certainly falsify some of the comparisons. In five of the remaining nine the hybrid value is intermediate, in one it is identical with the Old American, and in three there is no significant difference between one or more pairs of the series compared, and the departure from the more regular order may thus be attributed to chance. Apart from ear length, ear breadth and mouth width, which will be omitted in subsequent discussions of mean values, five of the differences between the hybrid and the unmixed Negroes and six between the hybrids and the Whites are significant.

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* Standard errors of the hybrid Negroes have been found from standard deviations calculated from Herskovits's distributions.

III. JAMAICAN 'BROWNS'

Primarily a comparative study of three adult groups, Blacks, Whites and 'hybrids between them of all degrees', this much-discussed work by Davenport & Steggerda (1929) also includes observations on several hundred children. The 'genetical (or near genetical) classes' are defined as follows: 'Black denotes an individual whose genetic constitution, so far as it is possible to ascertain, is that of a pure African type... Brown indicates a hybrid—sambo, mulatto, quadroon or more complex cross.... Whites have a genetic constitution of an European as nearly as can be ascertained.' Questions were asked of individuals concerning their pedigrees, and in addition to each subject's answer, opinions of his or her colour were obtained from other persons. In a few instances in which details of such statements were insufficient or did not concur, 'physical evidence...the result of observations on the span, hair curl, nose breadth, cephalic index, photograph', etc., was used as an aid to arriving at a decision. The measurements were made by a single observer, Steggerda, and should therefore be comparable *inter se*.

Although an abstract at the beginning of the work describes the adults as 'agricultural' and 'Jamaican', an examination of the text shows that both terms must be qualified. Students, farmers, sailors and townspeople are all represented, and almost half the hundred Whites come from the largest of the Cayman Islands, lying approximately 300 miles distant from Jamaica, of which they form a dependency. The Caymanian Whites are said to be 'descendants of shipwrecked mariners, and possibly from some of the old buccaneers', their ancestry being English. The fifteen Kingston Whites are 'the offspring of old British families who have lived in Jamaica for generations', but the thirty-two largely inbred Whites from Seaford Town appear to be of German descent.

The statement that all the subjects forming the adult series were 'fully grown, or practically so', would also seem to be somewhat questionable when the frequency distributions of ages are examined. Almost 13 % of the male Blacks, a little over 31 % of the male Browns and 16 % of the male Whites fall in the age-group 16–19 inclusive, while rather more than 25 % of the female Blacks, 41 % of the female Browns and 44 % of the Whites are under 20, three individuals, i.e. 6 %, in the last series but none in the other two falling in the age-group 13–15 inclusive. In the circumstances, it is exceedingly doubtful whether the mean absolute measurements can be legitimately compared, and the present analysis will be restricted to the means of indices, which are less likely to be affected by the possible effects of growth changes.

The means of twenty indicial characters are given by Davenport & Steggerda, but owing to the manner in which certain of the component absolute measurements were taken, in the female

Table 5. *Comparison of means of male and female Jamaican Blacks, Browns (hybrids) and Whites**

Character	Males						Females					
	Means and standard errors			Critical ratios			Means and standard errors			Critical ratios		
	Blacks (N)	Browns (H)	Whites (E)	N and H	H and E	N and E	Blacks (N)	Browns (H)	Whites (E)	N and H	H and E	N and E
Relative sitting height	51·5±0·21 (54)	51·5±0·15 (93)	53·3±0·18 (50)	—	7·7	6·5	51·6±0·18 (51)	52·4±0·19 (72)	53·1±0·19 (50)	3·1	2·7	6·1
Relative kneeling height	74·0±0·12 (54)	74·2±0·09 (93)	74·8±0·07 (50)	—	5·3	5·8	74·1±0·09 (50)	74·4±0·10 (72)	75·0±0·13 (50)	2·2	3·7	5·7
Relative span	106·2±0·38 (53)	106·2±0·30 (93)	102·7±0·46 (50)	—	6·4	5·9	105·2±0·33 (51)	103·9±0·37 (72)	101·1±0·31 (50)	2·6	5·8	9·1
Relative arm length	33·8±0·16 (52)	34·0±0·12 (91)	33·0±0·17 (50)	—	4·8	3·4	33·8±0·17 (49)	33·3±0·15 (68)	32·8±0·14 (49)	2·2	2·4	4·5
Total arm length-upper arm length index	40·6±0·16 (54)	41·2±0·17 (88)	41·4±0·25 (47)	2·6	—	2·7	40·5±0·20 (49)	40·6±0·16 (71)	41·6±0·16 (44)	—	4·0	4·0
Total arm length-forearm length index	31·7±0·20 (54)	31·8±0·18 (88)	31·2±0·24 (47)	—	—	—	31·6±0·22 (49)	31·6±0·17 (71)	31·1±0·22 (45)	—	—	—
Brachial index	77·9±0·77 (54)	76·7±0·60 (93)	75·8±1·07 (48)	—	—	—	77·8±0·81 (50)	78·0±0·73 (72)	74·2±0·71 (49)	—	3·7	3·3
Hand index	43·2±0·34 (53)	43·6±0·31 (89)	44·9±0·37 (49)	—	2·7	3·4	42·4±0·40 (50)	42·0±0·32 (71)	42·9±0·38 (46)	—	—	—
Foot index	37·7±0·28 (53)	37·7±0·21 (89)	37·8±0·30 (48)	—	—	—	38·3±0·37 (44)	37·5±0·33 (39)	36·5±0·33 (44)	—	2·1	3·6
Cephalic index	77·4±0·38 (54)	78·0±0·29 (93)	79·4±0·48 (50)	—	2·5	3·3	78·3±0·43 (51)	79·1±0·41 (72)	80·2±0·55 (50)	—	—	2·7
Head length-head height index	66·2±0·40 (53)	66·5±0·28 (93)	67·7±0·52 (49)	—	2·0	2·3	66·5±0·43 (49)	66·7±0·38 (68)	68·2±0·49 (50)	—	2·4	2·6
Head breadth-head height index	85·9±0·47 (53)	85·5±0·35 (93)	85·5±0·40 (50)	—	—	—	85·2±0·53 (49)	84·6±0·44 (68)	85·6±0·45 (50)	—	—	—
Parieto-frontal index	76·8±0·64 (54)	75·7±0·47 (92)	77·8±0·37 (49)	—	3·5	—	77·4±0·55 (50)	77·3±0·46 (72)	76·9±0·39 (49)	—	—	—
Zygomatico-pupillary index	47·1±0·25 (53)	46·1±0·26 (93)	43·5±0·27 (48)	2·8	6·9	9·8	46·1±0·32 (51)	45·8±0·28 (72)	43·4±0·22 (50)	—	6·7	7·0
Facial index†	91·4±0·75 (54)	90·3±0·54 (93)	90·9±0·90 (49)	—	—	—	91·7±0·77 (50)	90·7±0·59 (71)	90·4±0·76 (50)	—	—	—
Nasal index	95·0±1·42 (42)	88·4±1·10 (80)	67·6±0·93 (41)	3·7	14·4	16·1	87·0±1·87 (30)	82·4±1·14 (51)	66·2±1·10 (42)	2·1	10·2	9·6
Ear index	57·6±0·50 (54)	57·0±0·64 (92)	51·9±0·74 (50)	—	5·2	6·4	57·0±0·82 (51)	54·8±0·70 (72)	51·3±0·72 (50)	2·0	3·5	5·2

* Standard errors for these series were found from the standard deviations provided by Davenport & Steggerda (1929).

† The published mean value of the facial index for male Browns, 89·3, appears to be incorrect. That now substituted has been recalculated from Davenport & Steggerda's distribution for the character in question.

series at least, three of them, sitting suprasternale height-chest breadth index, pelvic breadth-shoulder breadth index and stature-chest girth index, seem likely to be less accurate than the seventeen others, the means of which are compared in Table 5.

For both the male and the female series the numbers of Blacks and Whites are almost equal, but both are less than the number of Browns. Comparisons between the Browns and the Blacks and the Whites would therefore be expected to show more significant differences if all the types are in fact equidistant from one another. Actually, however, the Blacks and Browns differ significantly in only three characters in the case of the male series and in six in the case of the female. While male and female Blacks differ from male and female Whites in eleven and twelve characters respectively, male and female Browns differ from male and female Whites in eleven characters each. Also, none of the Black-Brown differences is markedly significant, but many between the White and the coloured series are so. These relations suggest that the types of the two coloured populations are very close and at the same time well removed from that of the White. The few characters that do distinguish the Blacks from the Browns may be noted. They are relative sitting height, relative span, relative arm length, relative kneeling height and ear index (only the female means being significantly different), total arm length-upper arm length index and zygomatico-pupillary index (only the male means being significantly different) and nasal index (the means for both sexes being significantly different). For five of these eight characters, the Brown mean lies between those of the Black and White in the case of both sexes. In two of the remaining cases, relative sitting height and relative span, the female Brown means are also intermediate, while the Black male means are identical with the Brown. In the third, relative arm length, the female Brown mean is intermediate but the male is not. For the last character, however, the male Black and Brown means do not differ significantly. It is of some interest to examine the order in which the various series are arranged by their mean values without regard to significant differences between them. Of the total of seventeen characters the order is Black, Brown, White in nine cases for the males and thirteen for the females. In the remainder the differences between the Black and Brown, Brown and White, or Black, Brown and White means are insignificant so that the departure from the more normal order may be the result of chance. The evidence suggests most forcibly that the averages of the hybrid group tend to lie between those of the parental populations in the case of all the characters considered. So far as the Jamaican material is concerned, this is as conclusive as might be expected when account is taken of fluctuations due to random sampling.

IV. HALF-BLOOD SIOUX

A study by Sullivan (1920) of full- and half-blood Sioux, based on an investigation made at the World's Columbian Exposition in Chicago in 1893 by Professor Franz Boas and eight assistants (Boas, 1895), is of considerable value from the point of view of its clear presentation of anthropometric data.

The third largest Indian tribe in the United States, the Sioux, or more correctly Dakota, number some 35,000 (Wissler, 1934). This is 10,000 greater than their estimated strength in 1780 and 11,000 greater than the figure given for them in the reservation census of 1860. According to Sullivan, the non-indigenous peoples with whom the Sioux have mixed are principally French, Scots, English and Irish, and in attempting to assess the anthropological position of the hybrids the difficulty of obtaining appropriate comparative material for the European parental population, itself far from unique in origin, must again be stressed. The most suitable choice for the purpose in view would seem to be the Old Americans of Hrdlička (1925), already used in the comparison of Herskovits's Negroes.

Sullivan gives the means and standard errors and constants of variation of fourteen absolute and eight indicial characters for 'pure' Sioux and half-bloods of both sexes.* Only adult male full- and half-bloods will be considered in the present analysis, the number of adult female half-bloods being inadequate for purposes of comparison. The ages of the 540 adult male full-bloods—hereafter referred to simply as 'Sioux'—and the 77 adult male half-bloods range from 20 to 59 years inclusive. No measurements on the same individuals which might have been used to ascertain the personal equation of the several observers were made, but, with the exception of characters involving the nasion as a terminal point and, to a lesser degree, the shoulder breadth and height and the arm length, their results are in general agreement. After the exclusion of unreliable measurements, nine characters can be used for a comparison of the half-bloods with the Sioux and the Old Americans. Means of the three series are compared in Table 6.

TABLE 6. *Comparison of means of male Sioux, half-bloods and Old American Whites*†

Character	Means and standard errors			Critical ratios		
	Sioux (N)	Half-bloods (H)	Whites (E)	N and H	H and E	N and E
Stature	172·4 ± 0·24 (537)	173·5 ± 0·78 (77)	174·3 ± 0·22 (727)	—	—	5·8
Span	181·4 ± 0·30 (535)	182·4 ± 0·80 (76)	179·2 ± 0·47 (245)	—	3·4	3·9
Head length	194·9 ± 0·26 (539)	194·4 ± 0·81 (77)	197·1 ± 0·22 (727)	—	3·2	6·5
Head breadth	155·1 ± 0·23 (539)	154·3 ± 0·57 (77)	153·9 ± 0·19 (727)	—	—	—
Bizygomatic breadth	149·1 ± 0·23 (538)	143·4 ± 0·63 (76)	138·6 ± 0·31 (247)	8·5	6·8	27·2
Physiognomical facial height	189·9 ± 0·45 (330)	186·4 ± 0·98 (55)	184·5 ± 0·73 (147)	3·2	—	6·3
Nasal breadth	39·9 ± 0·14 (540)	37·6 ± 0·35 (77)	36·1 ± 0·16 (247)	6·1	3·9	17·9
Relative sitting height	51·4 ± 0·07 (536)	51·6 ± 0·22 (77)	52·9 ± 0·08 (247)	—	5·6	14·1
Cephalic index	79·6 ± 0·14 (537)	79·4 ± 0·30 (77)	77·9 ± 0·11 (727)	—	4·7	9·6

There are no significant differences between the Sioux, half-bloods and Old Americans for head breadth and none between the Sioux and the half-bloods for stature, span, head length, relative sitting height and cephalic index, although these characters differentiate the half-bloods from the Old Americans. For physiognomical facial height, the half-bloods are significantly different from the Sioux but not from the Old Americans. The two remaining characters, bizygomatic breadth and nasal breadth, show significant differences between all three series.

Expressed in another way, it may be said that the half-bloods differ significantly from the Old Americans in six of the nine characters compared and from the Sioux in three of them, but in all but one character, head breadth, the Sioux are significantly different from the Old

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* The term 'half-blood' includes individuals said to be a quarter and three-quarters Indian, but a few vaguely described as mixed-bloods were omitted by Sullivan from his half-blood series.

† Standard errors of the Sioux and half-bloods are taken from Sullivan (1920). Standard errors of the Old Americans were found from the standard deviations provided by Hrdlička (1925) and Herskovits (1930), except in the case of span, physiognomical facial height and relative sitting height, the standard deviations of which have been calculated from Hrdlička's distributions for these characters.

Americans. The greatest differences between the last two series are in bizygomatic breadth (27·2), nasal breadth (17·9) and relative sitting height (14·1), the rest being under 10.

It may be tentatively concluded from the above evidence that the hybrids are closer to the Indian stock, from which they certainly derive in part, than to a European group presumed in default of more satisfactory material to represent the other parental population. An examination of the means shows that the order is Sioux, half-bloods, Old Americans in six cases and half-bloods, Sioux, Old Americans in the other three. But in these last there are no significant differences between the half-bloods and the Sioux and such a discrepancy may well be due to chance.

V. OJIBWA-WHITES

Only three characters are considered in a study by Jenks (1916) of crosses between Ojibwa Indians and Whites, mainly from the state of Minnesota. These are head breadth, bizygomatic breadth and the resulting parieto-zygomatic index, but as has been seen in the discussion of Sullivan's study, the second of them is particularly useful in differentiating American Indian hybrids from their ancestral stocks.

After recounting the circumstances in which his investigation was carried out, Jenks gives an historical sketch of the amalgamation of Indians and Whites in the Lake Superior region and says that it has been 'continuous and cumulative' since 1660. 'In 1670, the Hudson's Bay Company was organized and for two hundred years dominated the upper Ojibwa area. It early entered the field of the Minnesota Ojibwa with its force of hardy French and Scotch traders.... It was the rare and exceptional trader who did not have at least one Indian wife.'

The Ojibwa or Chippewa are the largest Algonkian tribe, Hrdlička (1916) putting their strength then at well over 25,000. Both he and Jenks, however, comment on the scarcity of full-bloods among them at the present time. Jenks gives means, mean variations, and individual measurements for the three characters referred to of eighty adult male and eighty-six adult female Ojibwa-Whites, twenty-four adult male and nineteen adult female full-blood Ojibwa, a hundred adult male Minnesota French, 'most of whom were born in Canada but now reside within thirty miles north of Minneapolis', and fifty adult male Minnesota Scots, three-quarters of whom were born in Scotland. He considers it probable that a few of the French have a slight infusion of Indian blood. Although some female French and Scots were measured, they are not included in his study, and the present treatment of the material will be limited to males, omitting the smaller White series of Scots, except when dealing with variability in § XII.

Jenks divides his male hybrid sample into three groups, the first consisting of eight subjects known to be at least three-quarters White, the second of twelve known to be at least half-White and the third of sixty who are less than half-White. These have now been pooled to form a more substantial series of eighty, representing all degrees of admixture but with a preponderance of Indian ancestry. Table 7 gives the means of male Ojibwa, Ojibwa-Whites and Minnesota French and the differences between them expressed as critical ratios.*

The order of the means for all three characters is Ojibwa, Ojibwa-Whites, French in every instance except that of head breadth where it is Ojibwa-Whites, Ojibwa, French, but in this case the difference between the Ojibwa and the Ojibwa-Whites is very small, 0·1 mm., and quite insignificant. The rest of the differences are of varying degrees of significance but show that the hybrids tend to lie closer to the Indian group than to the White. In such a connexion, it must be remembered that both head and bizygomatic breadths are highly correlated with each other and with the parieto-zygomatic index, of which they are components.

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* The values of the Minnesota Scots means for the three characters considered are all less than those of the Minnesota French.

TABLE 7. *Comparison of means of male Ojibwa, Ojibwa-Whites and Minnesota French**

Character	Means and standard errors			Critical ratios		
	Ojibwa (N)	Ojibwa-Whites (H)	French (E)	N and H	H and E	N and E
Head breadth	156·5 ± 0·80 (24)	156·6 ± 0·52 (80)	153·4 ± 0·56 (100)	—	4·2	3·2
Bizygomatic breadth†	152·1 ± 0·71 (24)	147·4 ± 0·68 (80)	139·3 ± 0·54 (100)	4·7	9·3	14·0
Parieto-zygomatic index	97·2 ± 0·46 (24)	94·1 ± 0·32 (80)	90·8 ± 0·31 (100)	6·1	7·4	12·6

VI. YUCATECANS

The field work for a most comprehensive monograph by Williams (1931) on Maya-Spanish crosses was carried out in 1927 in the Mexican state of Yucatan, its purpose being 'to collect data relating to the physical anthropology of the Maya Indians of that region and to study the physical effects of race mixture between the Maya Indians and their conquerors'. A male series of 880 and a female of 694 from the hemp plantations and urban centres of Yucatan are considered. 'The men and women represent the progeny of crosses between the indigenous Maya population and White conquerors and immigrants. The mixture has continued over a period of some 350 years. The Whites have been for the most part of Spanish nationality. The Indian participants have always been numerically preponderant. In comparative isolation these two stocks (and practically no others) have interbred during a sufficiently long period to have produced a great many of the various types possible.' The author rightly contends that the biological group alone 'can serve for an inquiry into racial characters', and he goes on to say that 'no worth-while data on racial attributes can be secured in the absence of a reliable technique for the isolation of racial types'. The rest of the paragraph in which these words appear and the whole of the succeeding one may be quoted to show his attitude:

> It is fatuous to attempt a study of the varying mental or physical capacities of races when the investigator has neither a clear conception of what races are, nor any reliable methods of separating heterogeneous populations into racial types.
>
> *The object of this study is to demonstrate the practicability of resolving a racially mixed and heterogeneous population into significantly differing sub-groups which present a uniformity of physical characters, adaptive and non-adaptive, sufficient to justify the conclusion that relatively pure racial types have been distinguished.*

Williams then proceeds to subdivide his material into five groups approximating in various degrees to the types of the parental populations. His sorting criterion is the possession of White and Indian non-adaptive traits by particular subjects. 'Each individual of the cross is said to possess a definite racial status. An individual is a member of a pure racial group because he possesses certain non-adaptive traits derived from common descent of the group's members.' It is not proposed to discuss arguments in favour of or against such a view, but to deal with the combined Yucatecans in the same manner as the other hybrid samples are treated in this study.

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* Standard errors of all these series were found from standard deviations calculated from Jenks's individual measurements.

† The means of this character for the Ojibwa and the French have been recalculated from individual measurements and differ slightly from the values published by Jenks (1916).

For comparative material a series of Mayas measured by Steggerda (1932*b*) four years after Williams's expedition and another of Spanish university students communicated to Williams by Barras are available. Barras's data are limited to head measurements of males from all parts of Spain, but to these can be added the stature of a male series from Andalusia measured by Hulse (1934).* Steggerda has estimated that none of his subjects possesses more than one-eighth to three-sixteenths of White blood and that all of them are 'relatively pure Maya'.

TABLE 8. *Comparison of means of male Mayas, Yucatecans and Spanish*†

Character	Means and standard errors			Critical ratios		
	Mayas (N)‡	Yucatecans (H)	Spanish (E)	N and H	H and E	N and E
Stature	155·1 ± 0·60 (77)	156·4 ± 0·19 (865)	166·5 ± 0·28 (416)	2·1	29·8	17·2
Head length	180·4 ± 0·61 (77)	182·6 ± 0·20 (880)	191·3 ± 0·85 (79)	3·4	10·0	10·4
Head breadth§	153·9 ± 0·56 (77)	155·6 ± 0·18 (880)	149·4 ± 0·53 (79)	2·9	11·1	5·8
Bizygomatic breadth	143·0 ± 0·73 (50)	142·3 ± 0·16 (880)	133·3 ± 0·66 (78)	—	13·3	9·9
Bigonial breadth	106·1 ± 0·78 (50)	105·7 ± 0·18 (878)	101·7 ± 0·67 (78)	—	5·8	4·3
Nasal breadth	38·2 ± 0·35 (50)	37·7 ± 0·10 (880)	33·0 ± 0·35 (79)	—	12·9	10·5
Ear length	61·7 ± 0·53 (50)	60·6 ± 0·15 (706)	61·4 ± 0·45 (79)	—	—	—
Ear breadth	32·5 ± 0·36 (50)	31·6 ± 0·10 (706)	34·1 ± 0·34 (79)	2·4	7·1	3·2
Cephalic index	85·0 ± 0·32 (77)	85·2 ± 0·11 (880)	78·3 ± 0·36 (79)	—	18·3	13·9
Ear index	52·2 ± 0·46 (50)	52·3 ± 0·16 (706)	55·4 ± 0·56 (79)	—	5·3	4·4

The means of the male Mayas, Yucatecans and Spanish are compared in Table 8. Of the ten characters considered, four show significant differences between Mayas and Yucatecans, all of a low order. Between both Yucatecans and Spanish, and Mayas and Spanish, nine of the differences are significant, those for the second pair of groups being in eight cases greater than those for the first. This result, on the face of it, may seem somewhat surprising, but it is almost certainly due to the size of the Yucatecan sample, which is roughly ten times as large as those of the Maya and the Spanish.

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* Comparisons are restricted to male subjects, there being no adequate female Spanish series available for this purpose. After a survey of the post-Columbian history and population of Yucatan, Williams concludes that 'all the various elements of the Spanish nation were involved in the race mixture with Indians that took place after the discovery of the New World'.

† Standard errors of the Mayas were found from the standard deviations provided by Steggerda (1932*b*), with the exception of that for head breadth, which was calculated from his distribution for this character after adding to it the measurement of a subject with an extremely broad head, omitted by him, as he states, 'perhaps without justification'. Standard errors of the Yucatecans and the Spanish were found from Williams's and Hulse's standard deviations. The mean age of Steggerda's seventy-seven male Mayas is 30·6 years, six, or roughly 18 % of them being from 15 to 17½. Williams remarks that fifty-seven of Barras's series of seventy-nine Spanish are 18 or more years of age, and that twenty-two aged 17, whose means do not differ significantly from those of the older age-group, have been added to it. The mean age of Williams's total series of male Yucatecans is 34·1 years, although subjects under 18 were excluded by him when calculating the mean for stature.

‡ The following means of a sample of 100 adult male Mayas measured by Starr (1902) may be compared with Steggerda's values for the same characters: stature 155·2, head length 181·8, head breadth 154·1, bizygomatic breadth 144·2, nasal breadth 37·5, cephalic index 85·0. The means of a further series of adult male Mayas also measured by Steggerda (1941) are: stature 155·4 (128), head length 180·2 (128), head breadth 153·7 (105), bizygomatic breadth 142·6 (105), bigonial breadth 107·0 (105), nasal breadth 39·5 (104), ear length 62·3 (96), ear breadth 33·3 (96), cephalic index 85·3 (127) and ear index 53·4 (96).

§ The Maya mean for head breadth is the revised one including the measurement of the subject omitted by Steggerda (see note † above).

For all characters except four, the Yucatecan means fall between those of the Mayas and Spanish. For head breadth and cephalic index the Yucatecan mean is one of the extremes and the Maya mean intermediate. No importance can be ascribed to such a fact in the case of the cephalic index, as the Maya and Yucatecan means differ insignificantly for it. On the other hand, the values for head breadth of the two American groups must be considered significant but not highly so. This is a rare exception to what appears to be a general rule. The other two characters referred to are ear length, for which the differences between all the series are insignificant, and ear breadth, for which the position is the same as for head breadth. Little weight need be attached to the observed relations between the mean ear breadths, however, since the deviation is probably due to the way in which this character was measured by the three different observers. Steggerda's technique is described in his study, but Williams does not state what methods he or Barras employed in measuring the Yucatecans and the Spanish. As far as head breadth and cephalic index are concerned, however, it seems unlikely that the same explanation can be given.

It should be noted that for all characters except ear length, in which it has already been pointed out that the three series are undifferentiated,* the absolute differences between the Maya and Yucatecan means are decidedly smaller than those between the Yucatecans and the Spanish. In view of the fact that the Indian element in the cross has always been greater than the Spanish, such a result might well have been expected.

VII. REHOBOTH BASTAARDS

The work of Fischer (1913) on the Bastaards of Rehoboth, a hybrid people living in south-west Africa, is unfortunately not very extensive in its detailed treatment of anthropometric characters. Individual measurements of seventy-four adult male and ninety adult female Bastaards for three absolute and eleven indicial characters are given, but no more than four of these can be used for purposes of comparison.†

According to Fischer, the Bastaards are mainly the product of Boer-Hottentot crosses, and when investigated by him in 1908 they numbered some 2500. The names of their male European forefathers are said to be generally known, but there is no certain information regarding the identity of the Hottentot females with whom they formed alliances. The accuracy of the register on which Fischer depends for statements concerning the European ancestry of his subjects is questioned by Rodenwaldt (1927, p. 110), and Lotsy & Goddijn (1928, pp. 205–7) conclude that 'very little is known with certainty about the origin of the Bastaards, except that there was white and coloured blood in them'. The 'Boers' who entered into the cross were Cape Dutch, with some Huguenot admixture, and German and British. Working on a genealogical basis, Fischer divided his material into three main groups, 'Eu', 'Mitt' and 'Hott'. In the 'Eu' and 'Hott' groups, respectively, European and Hottentot elements preponderate, while the 'Mitt' group includes persons in whom both these are represented to an approximately equal degree. A fourth group is composed of subjects whose ancestry could not be ascertained.

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* Ear length, ear breadth and ear index will be omitted in further considerations of mean values, owing to the doubt regarding their comparability.

† It has been learned with regret from Dr J. Schaeuble of Freiburg-im-Breisgau that the original records, which Professor Fischer had bequeathed to the Anatomical Institute of Freiburg University and which had been deposited there in a cellar for safety, were destroyed during an air-raid on 29 November 1944.

It is thus seen that the selection of comparative material is made extraordinarily difficult by lack of knowledge of the affinities of the various stocks which entered into the formation of the cross. Fischer himself was able to obtain only eight male and seven female Hottentots for comparison with the Bastaards, and for the European side of their ancestry he used a German series from Baden. For the present analysis, two series, one of seventy-four male Hottentets measured by Schultze (1928) and another of seventy male Dutch measured by Steggerda (1932*a*) have been chosen. Considered separately, Fischer's male subseries—the 'Eu' group containing twelve, the 'Mitt' thirty-two, the 'Hott' twenty-three, and the unknown seven, individuals—are too small for satisfactory statistical treatment, but he has also furnished means for the sample as a whole, in which there is a slight preponderance of Hottentot ancestry. Schultze's subjects were studied principally at Keetmanshoop, Rooibank and Walvis Bay and were drawn from a number of local groups. All of them, apart from two Griquas, belonged to the Nama or Namaqua division of the Hottentots. About half Steggerda's Dutch were born in the United States and half in Holland, their ancestors all coming from the northern provinces of the Netherlands. For the four characters used to compare the Hottentots, Bastaards and Dutch, this series is probably as satisfactory as any that can at present be found to represent the non-indigenous ancestry of the Bastaards, although its stature is in excess of that of most contemporary western European populations.

The means of the male Hottentots, Bastaards and Dutch are compared in Table 9. In every case the three series are significantly differentiated from one another, and the value of the Bastaard mean falls between those of the presumed parental groups. A greater number of characters would be necessary before even the most tentative conclusions could be drawn as to the relationship of the Bastaards to the populations with which they are compared, but it might be suggested that the intermediate position of the hybrid means is a striking illustration of what appears to be a general law. Since this section was originally drafted, however, the writer has had grave doubts whether the facial and nasal heights of the Hottentots were actually taken in the manner stated by Schultze (Trevor, 1947, pp. 65–6), and perhaps the same is true of Fischer's measurements of the two characters in question. The point could not be resolved until further anthropometric data were obtained for comparison. Through the kindness of Dr L. H. Wells of Edinburgh University, the unpublished means and standard deviations of a sample of Hottentot males studied by him have been made available for such a purpose. The mean facial and nasal heights of Schultze's Hottentots are 105·9 ± 0·43 (74) and 41·9 ± 0·43 (74), and those of Wells for the same characters 116·4 ± 1·27 (30) and 51·2 ± 0·86 (31) respectively.* Both differences are markedly significant, the critical ratios being 6·9 in the case of facial height and 9·7 in that of nasal height. Keen (1947) found a mean facial height of 113·8 ± 1·28 (35) and a mean nasal height of 47·7 ± 0·52 (35) in a series of 'typical' Hottentot crania, which were unsexed.* His values are several millimetres larger than Schultze's for analogous characters taken on living subjects, whereas, owing to the thickness of the superposed tissues in the latter, precisely the opposite result might have been expected. Such an expectation is satisfied by Wells's means for the same characters. In the absence of comparative material, a similar analysis of Fischer's measurements of male Rehoboth Bastaards cannot be undertaken, but the small mean values for facial height, 114·6 (67), and nasal height, 48·8 (66), of the pooled 'Eu', 'Mitt' and 'Hott' subseries suggest that here, too, a landmark below the level of the anatomical nasion, possibly the 'sellion' (see Trevor, 1950, p. 462), may well have been used as their upper terminal.†

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* Sample standard deviations of these and certain other absolute measurements for Schultze's male Hottentots are provided by Trevor (1947, p. 74, footnote), and the standard errors now given have been found from them. Standard errors of Wells's male Hottentots have been found from his unpublished standard deviations, viz. facial height 6·93 ± 0·89 (30) and nasal height 4·80 ± 0·61 (31).

TABLE 9. *Comparison of means of male Hottentots, Rehoboth Bastaards and Dutch*‡

Character	Means and standard errors			Critical ratios		
	Hottentots (N)	Bastaards (H)	Dutch (E)	N and H	H and E	N and E
Stature	162·4 ± 0·76 (73)	168·4 ± 0·83 (69)	173·2 ± 0·87 (70)	5·3	4·0	9·4
Cephalic index§	72·9 ± 0·30 (74)	76·1 ± 0·28 (74)	79·3 ± 0·46 (70)	7·8	5·9	11·7
Facial index	80·6 ± 0·59 (74)	83·7 ± 0·65 (74)	87·7 ± 0·94 (41)	3·5	3·5	6·4
Nasal index	100·1 ± 1·16 (74)	85·5 ± 0·97 (73)	62·5 ± 1·19 (40)	9·7	15·0	22·6

TABLE 10. *Comparison of Schultze's and Wells's means for male Hottentots and Steggerda's Dutch*||

Character	Means and standard errors			Critical ratios		
	Schultze's Hottentots (N)	Wells's Hottentots (N′)	Steggerda's Dutch (E)	N and N′	N′ and E	N and E
Stature	162·4 ± 0·76 (73)	159·6 ± 0·92 (31)	173·2 ± 0·87 (70)	2·3	10·7	9·4
Cephalic index	72·9 ± 0·30 (74)	74·1 ± 0·52 (31)	79·3 ± 0·46 (70)	2·0	7·5	11·7
Facial index	80·6 ± 0·59 (74)	86·2 ± 1·05 (30)	87·7 ± 0·94 (41)	5·5	—	6·4
Nasal index	100·1 ± 1·16 (74)	85·6 ± 1·47 (31)	62·5 ± 1·19 (40]	7·7	12·2	22·6

* The original memoir does not specifically state this, but reference is made to the fact in a later paper by Keen (1951, p. 34). According to Dr Wells (in litt.), Keen's 'typical' Hottentot series is likely to contain a preponderance of male, and the 'typical' Bushman series treated with it, a preponderance of female skulls. His standard deviations, from which the standard errors now given have been found, do not appear to be particularly large.

† The Bastaard facial height has been calculated by weighting and pooling the 'Eu', 'Mitt' and 'Hott' means for this character and the facial height from the weighted and pooled values for the mean nasal breadth and nasal index for the same three subseries (Fischer, 1913, pp. 77 and 92).

‡ Standard errors of the Hottentots and Bastaards were found from standard deviations calculated from Schultze's and Fischer's individual measurements and those of the Dutch from the standard deviations provided by Steggerda (1932*a*). None of the Hottentots is recorded as being under 20 years of age. Four subjects aged 19 and two aged 18 are included in the Bastaard series. Their mean stature is 0·6 cm. greater than that of individuals of or over 20. The mean age of the Dutch is 35.

§ The Bastaard mean for cephalic index was recalculated from Fischer's individual measurements. His published values for the total male Bastaard series, 75·8, and for the 'Mitt' group, 75·5, appear to be incorrect. The mean for the last found from individual measurements is 76·2.

|| Standard errors of Wells's Hottentots have been found from his unpublished standard deviations, viz. stature 5·13 ± 0·65 (31), cephalic index 2·87 ± 0·36 (31), facial index 5·76 ± 0·74 (30) and nasal index 8·16 ± 1·04 (31).

The present problem, however, is essentially concerned with the stature and the cephalic, facial and nasal indices of Schultze's and Wells's male Hottentots and with the extent to which they are differentiated *inter se* and from Steggerda's Dutch. The means of the four characters are compared in Table 10. The differences between the two Hottentot series for stature and cephalic index are only just significant by the criterion employed in this study, but for the facial and nasal indices they are appreciably so. With the exception of the facial index, in which the Hottentots measured by Wells do not differ significantly from the Dutch, there is an evident separation between each of the non-European groups on the one hand and the European group on the other. Because of doubt regarding the legitimate comparability of the facial and nasal indices given in Table 9, these characters will be omitted from further treatment of mean values. They will nevertheless be retained for the comparison of standard deviations in § XII, since here the supposed divergence in technique is unlikely to affect measures of dispersion to any sensible degree. In this connexion, while Wells's data, unlike Schultze's, suggest most forcibly that no significant difference exists between the means for facial index in the Hottentots and the Dutch, the results of both observers concur in showing that a clear differentiation in the mean nasal index marks off the native Africans from the Europeans, a point so familiar that it is almost unnecessary to labour.

VIII. KISAR MESTIZOS

The small island of Kisar lies in the Sunda archipelago some 35 miles from the eastern extremity of Timor. Among its 6000 inhabitants is a community of mixed descent, derived mainly from crosses between soldiers in the service of the Dutch East India Company and native women. Certain traditions of the Mestizos, who have been studied by Rodenwaldt (1927), go back as far as the Portuguese occupation of the seventeenth century. In addition to Dutch and Portuguese, French, Germans and possibly one or two other nationalities are included in the Mestizos' European ancestry.

Rodenwaldt's adult Mestizo series consists of eighty male and fifty-five female subjects. For local comparative material he uses the measurements of thirty-nine adult male and twenty-five adult female Kisarese, who are themselves divided into three castes, Marna (nobles), Boer or Wuhuru (peasants) and Stam (slaves). In default of better material, Steggerda's Dutch are taken to represent the European ancestors of the Mestizos.

Rodenwaldt has divided the Mestizos into four groups according to the approximate numbers of European and indigenous ancestors in each, but the sizes of these are nearly all too small to permit of their satisfactory analysis, and only his means and constants of variation for the whole sample, in which the native element preponderates, will be considered here. For the same reason, Rodenwaldt's values for the total Kisarese are used instead of the separate ones for Marna, Boers and Stam.

Unfortunately, the great majority of the forty-nine metrical characters given are available for only fifteen male and eight female Kisarese, stature, head length, head breadth and cephalic index alone being based on more substantial samples, to which the present comparison is therefore restricted. For male stature, head length and head breadth of the Kisarese, Marna and Boers, and for male cephalic index, Marna, Boers and Stam are taken together. Apparently no measurements of female Stam were made.

TABLE 11. *Comparison of means of male and female Kisarese, Mestizos and Dutch**

Character	Males						Females					
	Means and standard errors			Critical ratios			Means and standard errors			Critical ratios		
	Kisarese (N)	Mestizos (H)	Dutch (E)	N and H	H and E	N and E	Kisarese (N)	Mestizos (H)	Dutch (E)	N and H	H and E	N and E
Stature	162·3 ± 1·03 (39)	164·9 ± 0·66 (79)	173·2 ± 0·87 (70)	2·1	7·6	8·1	152·3 ± 1·00 (25)	154·1 ± 0·76 (53)	161·8 ± 0·79 (60)	—	7·0	7·5
Head length	184·2 ± 0·94 (39)	187·0 ± 0·67 (79)	192·6 ± 0·83 (70)	2·4	5·3	6·7	179·1 ± 1·08 (35)	178·6 ± 0·97 (55)	185·2 ± 0·59 (59)	—	5·8	4·0
Head breadth	147·0 ± 0·61 (39)	150·4 ± 0·48 (79)	152·5 ± 0·80 (70)	4·4	2·3	5·5	141·1 ± 1·07 (25)	145·7 ± 0·60 (55)	148·2 ± 0·53 (60)	3·7	3·1	5·9
Cephalic index	79·9 ± 0·41 (47)	80·3 ± 0·39 (79)	79·3 ± 0·46 (70)	—	—	—	78·9 ± 0·67 (25)	81·3 ± 0·44 (55)	80·1 ± 0·35 (59)	3·0	—	—

* Standard errors of the Kisarese and the Mestizos are taken from Rodenwaldt (1927), and those of the Dutch have been found from the standard deviations provided by Steggerda (1932*a*). At least three Kisarese, two males and one female, are 18 years of age. Five of the male Mestizos are aged 18 and three 19. One of the female Mestizos is aged 17, two are aged 18 and three 19.

The order of the means in Table 11 shows that for all three absolute measurements the Mestizos fall between the Kisarese and Dutch, except in the case of the female head length, in which the Kisarese value is intermediate. Less weight can be given to this exception, however, as the female Kisarese series is based on only twenty-five individuals and its head length is not significantly differentiated from that of the Mestizos. As regards the cephalic index, the Dutch and the Kisarese are intermediate in the male and female series respectively, but the differences between the three male series are insignificant. The cephalic index of the female Kisarese is somewhat surprisingly a unit less than that of the males, but this is likely to have been brought about by the size of the female series which is probably too small to be a truly representative sample of the population from which it was drawn.

IX. NORFOLK ISLANDERS

The mutiny on H.M.S. *Bounty* in 1789 is sufficiently well known not to require a repetition of the circumstances under which it took place.* Towards the close of that year, nine mutineers, between ten and twelve Tahitian women and six or seven Tahitian men landed on Pitcairn Island, in the south Pacific.† Of the nine male Europeans, six left progeny as a result of unions with Polynesian females, and these and their descendants form the greater part of the contemporary population of Norfolk Island, to which the whole colony was removed in 1856, although various families returned to Pitcairn in the course of the next half-dozen years.

A study of the descendants of the *Bounty* mutineers by Shapiro (1929) includes a number of somatometric observations on the Norfolk Islanders. His adult series consists of sixty-four males and forty-nine females. For comparison a series of Society Islanders, measured in 1923 by Dr and Mrs E. S. Craighill Handy, whose data were reduced by Shapiro (1930), and another composed of Galton's 'English' for stature, sitting height and span‡ and of Oxfordshire villagers studied by Buxton, Trevor & Blackwood (1939) for head measurements, are available.

An examination of the orders of the means in Table 12 shows that in twelve of the fourteen characters compared the Norfolk Island values fall between those of the Society Islanders and the English in the case of the female series. For female stature the order is Norfolk Islanders, Society Islanders and English, but as the differences between the means of the three series for this character are all insignificant the observed result may well be due to chance. For female sitting height the Norfolk Island and the English means are identical. In the case of the males, the Norfolk Island means are intermediate for ten out of the fourteen characters. The Norfolk Island and English values may be considered identical for head length and parieto-zygomatic index, and there are no significant differences among the three series for bigonial breadth, in which the Society Island mean is intermediate. Although the Society Island and the English male means for stature are undifferentiated, the Norfolk Island value is greater than both of these,

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* A vivid account of the event and its aftermath can be found in Shapiro (1936).

† Neuville (1933, pp. 267, 270) states that there were six Polynesian men (four of them natives of Tahiti and two of Tubuai) and twelve Polynesian women (some natives of Tahiti and some of Rurutu and Raivavae), one of whom had with her an eleven-months-old female child.

‡ Stature, sitting height and span of the English are based on data collected by Sir Francis Galton in his First Anthropometric Laboratory, which was associated with the Health Exhibition held in London in 1884. The means and standard deviations of these characters were calculated by the present writer from the distributions given by Ruger & Stoessiger (1927) and by Elderton, Moul & Page (1928), subjects under the age of 20 being omitted.

TABLE 12. *Comparison of means of male and female Society Islanders, Norfolk Islanders and English**

Character	Males						Females					
	Means and standard errors			Critical ratios			Means and standard errors			Critical ratios		
	Society (N)	Norfolk (H)	English (E)	N and H	H and E	N and E	Society (N)	Norfolk (H)	English (E)	N and H	H and E	N and E
Stature	171·4±0·61 (85)	174·0±0·79 (64)	172·1±0·05 (5426)	2·6	2·4	—	161·1±0·63 (68)	161·7±0·72 (49)	160·4±0·16 (1498)	—	—	—
Sitting height	89·4±0·37 (85)	91·9±0·39 (64)	92·0±0·05 (5416)	4·7	—	7·0	83·9±0·59 (68)	85·7±0·50 (47)	85·7±0·09 (1494)	2·3	—	3·0
Span	180·1±0·80 (84)	179·4±0·94 (62)	177·0±0·10 (5415)	—	2·5	3·8	164·8±0·77 (65)	163·7±0·85 (48)	159·7±0·19 (1549)	—	4·6	6·4
Head length	188·0±0·71 (85)	195·6±0·73 (64)	195·5±0·66 (71)	7·5	—	7·7	178·9±0·77 (68)	185·6±0·77 (49)	186·1±0·37 (310)	6·2	—	8·4
Head breadth	159·6±0·54 (85)	155·5±0·54 (64)	151·4±0·55 (71)	5·4	5·3	10·6	154·1±0·66 (68)	150·6±0·69 (49)	145·8±0·26 (310)	3·7	6·5	11·7
Minimum frontal breadth	102·9±0·54 (85)	104·0±0·55 (64)	109·3±0·58 (71)	—	6·6	8·1	101·4±0·53 (67)	102·8±0·66 (49)	102·9±0·24 (306)	—	—	2·6
Bizygomatic breadth	145·7±0·56 (85)	140·9±0·66 (64)	137·7±0·55 (71)	5·5	3·7	10·2	138·9±0·60 (68)	134·0±0·67 (49)	129·1±0·32 (307)	5·4	6·6	14·4
Bigonial breadth	107·8±0·66 (85)	107·6±0·58 (64)	108·3±0·63 (71)	—	—	—	102·6±0·83 (68)	102·2±0·60 (49)	100·3±0·32 (307)	—	2·8	2·6
Nasal breadth	43·4±0·30 (85)	37·6±0·35 (64)	33·7±0·32 (71)	12·6	8·2	22·2	40·0±0·40 (68)	34·8±0·39 (49)	29·5±0·16 (307)	9·3	12·6	24·4
Cephalic index	85·0±0·42 (85)†	79·5±0·36 (64)	77·5±0·36 (71)	9·9	3·9	13·6	86·2±0·46 (68)	81·2±0·38 (49)	78·4±0·16 (310)	8·5	6·9	16·0
Parieto-frontal index	64·6±0·33 (85)	66·9±0·36 (64)	72·2±0·37 (71)	4·7	10·3	15·3	65·9±0·34 (67)	68·3±0·45 (49)	70·7±0·17 (306)	4·3	5·0	12·6
Parieto-zygomatic index	91·4±0·29 (85)	90·7±0·35 (64)	90·7±0·35 (71)	—	—	—	90·2±0·37 (68)	89·0±0·34 (49)	88·6±0·19 (307)	2·4	—	3·8
Zygomatico-frontal index	70·7±0·36 (85)	73·9±0·40 (64)	79·6±0·44 (71)	5·9	9·6	15·7	73·2±0·41 (67)	76·8±0·51 (49)	79·9±0·21 (304)	5·5	5·6	14·5
Zygomatico-gonial index	74·4±0·45 (85)	76·4±0·47 (64)	78·9±0·46 (71)	3·7	3·8	7·6	73·9±0·58 (68)	76·9±0·40 (49)	77·7±0·20 (305)	4·3	—	6·2

* Standard errors of the Society and Norfolk Islanders were found from the standard deviations provided by Shapiro (1929, 1930), those of the head measurements of the English being given in Buxton, Trevor & Blackwood (1939). Three of the male Norfolk Islanders are between the ages of 18 and 20, and three of the females are 17 and three 19 years of age.

† This value was misprinted as 88·0 in the table of means in Shapiro (1929).

but not to a particularly significant degree. It has been suggested that the tallness of the Norfolk Islanders may be due to heterosis or 'hybrid vigour'; in animal crosses, however, such a condition is usually manifested to its fullest extent by the first filial generation.

For most of the characters in the case of both male and female series for which definitely significant differences are found, the Norfolk Island mean falls approximately half-way between those of the two presumed parental populations. If no allowance is made for the possible effects of selection and differential birth- and death-rates, each Norfolk Islander studied by Shapiro may be regarded as possessing approximately equal amounts of English and Polynesian ancestry, and the observed relations of the mean values reflect the effects of such a suggestion in a very convincing fashion.

X. ANGLO-INDIANS*

In this study, which was issued in three parts, Mahalanobis (1922–40) discusses measurements taken on male Anglo-Indians of Calcutta by the late Dr Nelson Annandale, Director of the Zoological Survey of India, and his assistants during the years 1916–19. It must be admitted that information regarding the origin of the Anglo-Indian community is anything but precise. Dover (1937) states that among the Eurasians of what was then British India and of Malaya 'the new style "Anglo-Indians" or Eurindians form the largest, most misrepresented, and oldest group, its origin dating from the Portuguese occupation in the early sixteenth century, but more especially from intermarriages in the days of the East India Company between Britishers and native women or the indigenous descendants of previous European invasions', and he adds that 'Portuguese, Dutch and French genes...are more prevalent than is generally supposed'.

The elimination from his sample of recently incorporated Negriform and Mongoliform elements was attempted by Annandale, but not with complete confidence in his success as regards the latter. After the omission of incomplete and doubtful records, the individual measurements of seven absolute and two indicial characters for a series of 200 are provided in Part II of Mahalanobis' paper, those for stature having also appeared in Part I. (Part III deals with frequency distributions, age changes, intercorrelations of characters and linearity of regressions.) The ages of the subjects range from 15 to 48, and there are nine for whom no age is recorded. It has been thought advisable, however, to recalculate means and standard deviations for such characters as can be used for comparative purposes after excluding observations on all persons below the age of 20, together with those for whom no details of age are available. As now considered, the sample consists of 145 adult males.†

In his own work, Mahalanobis (1927) compared the original Anglo-Indian sample of 200 with a number of Bengali castes and tribes, for which he had revised measurements collected by Risley (1891–2), using two generalized criteria of divergence, the Pearsonian coefficient of racial likeness and his own modification of it. He provisionally concluded that 'intermixture between Europeans and Indians in Bengal appears to have occurred more frequently among the higher

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* The term 'Anglo-Indian' is used in its official sense as denoting a person of mixed European and Indian ancestry.

† The extraordinarily small mean of the Anglo-Indian bizygomatic breadth, 120·4, would seem to indicate that the measurement had been incorrectly taken, the lowest value found by Morant (1936, p. 28, footnote) in 156 *cranial* series of adequate size from various parts of the world being 122·5 for Badari Egyptians. For this reason, the bizygomatic breadth has been omitted from the present discussion.

Table 13. *Comparison of Risley's and Guha's means for male Bengali Brahmans, Kayasthas and Pods**

Character	Means and standard errors of Risley's series			Means and standard errors of Guha's series			Critical ratios		
	Brahmans (B)	Kayasthas (K)	Pods (P)	Brahmans (B′)	Kayasthas (K′)	Pods (P′)	B and B′	K and K′	P and P′
Stature†	165·6 ± 0·54 (100)	163·6 ± 0·54 (100)	162·5 ± 0·54 (100)	168·0 ± 0·76 (50)	167·1 ± 0·57 (100)	162·8 ± 0·69 (50)	2·8	4·5	—
Head length	181·8 ± 0·63 (100)	182·5 ± 0·63 (100)	183·2 ± 0·63 (100)	186·4 ± 0·85 (50)	185·3 ± 0·63 (100)	184·1 ± 0·94 (50)	4·3	3·1	—
Head breadth	143·3 ± 0·50 (100)	142·9 ± 0·50 (100)	142·5 ± 0·50 (100)	147·0 ± 0·73 (50)	149·6 ± 0·54 (100)	141·8 ± 0·70 (50)	4·2	9·1	—
Minimum frontal breadth	104·5 ± 0·37 (100)	101·7 ± 0·37 (100)	101·2 ± 0·37 (100)	104·5 ± 0·66 (50)	105·2 ± 0·38 (100)	102·6 ± 0·60 (50)	—	6·6	—
Bizygomatic breadth	128·2 ± 0·45 (100)	128·1 ± 0·45 (100)	129·3 ± 0·45 (100)	132·8 ± 0·71 (50)	134·7 ± 0·55 (100)	130·8 ± 0·54 (50)	5·5	9·3	2·1
Nasal breadth	35·1 ± 0·25 (100)	35·4 ± 0·25 (100)	37·5 ± 0·25 (100)	36·6 ± 0·43 (50)	37·1 ± 0·25 (100)	36·7 ± 0·33 (50)	3·0	4·8	—
Cephalic index	78·8 ± 0·34 (100)	78·3 ± 0·34 (100)	77·8 ± 0·34 (100)	78·9 ± 0·48 (50)	80·8 ± 0·39 (100)	77·1 ± 0·55 (50)	—	4·8	—

* Standard errors of Risley's three series were found from the mean standard deviations of a number of his north Indian castes calculated by Mahalanobis (1927). They are thus only approximate. Standard errors of Guha's three series were found from the standard deviations provided by him for each of them.

† The means for stature of Risley's three series were calculated from his individual measurements, those of the rest of the characters being the revised ones given by Mahalanobis (1933).

castes than the lower'. The reliability of Risley's material has recently been criticized by Guha (1935) on the grounds that its selection was probably influenced by preconceived notions of 'a standard type for each caste'.* Risley's and Guha's means for two higher and one middle caste Bengali series, Brahmans, Kayasthas and Pods, are compared in Table 13. It is evident that only in the case of the Pods can it be supposed that the same population is being dealt with by Risley and by Guha.

Table 14. *Comparison of means of male Pods (combined), Anglo-Indians and English*†

Character	Means and standard errors			Critical ratios		
	Pods (N)	Anglo-Indians (H)	English (E)	N and H	H and E	N and E
Stature	162·6 ± 0·40 (150)	166·1 ± 0·54 (145)	172·1 ± 0·05 (5426)	5·2	11·1	23·6
Head length	183·5 ± 0·55 (150)	182·3 ± 0·71 (145)	195·5 ± 0·66 (71)	—	13·6	14·0
Head breadth	142·3 ± 0·40 (150)	142·8 ± 0·50 (145)	151·4 ± 0·55 (71)	—	11·6	13·4
Nasal height	49·1 ± 0·30 (100)	50·6 ± 0·35 (145)	50·7 ± 0·43 (71)	3·3	—	3·1
Nasal breadth	37·2 ± 0·19 (150)	35·8 ± 0·25 (145)	33·7 ± 0·32 (71)	4·5	5·4	9·9
Cephalic index	77·6 ± 0·32 (150)	78·4 ± 0·35 (145)	77·5 ± 0·36 (71)	—	—	—
Nasal index	76·4 ± 0·54 (100)	71·3 ± 0·68 (145)	66·7 ± 0·82 (71)	5·9	4·3	9·9

The English series used in the comparison of the Norfolk Islanders may, with a great deal of misgiving, be tentatively considered to represent one side of the ancestry of the Anglo-Indians and the combined means of Risley's and Guha's Pods (apart from nasal height and nasal index in which Risley's values alone are comparable with those of the Pods and English) the other.

The means of the Pods, Anglo-Indians and English for seven characters are compared in Table 14. In four cases the Anglo-Indian mean lies between those of the Pods and the English. In the other three cases it does not, but here the differences among all the series or between a pair of them are insignificant and the exceptions may well be due to chance. While the results accord as satisfactorily as could be expected with previous comparisons, owing to the doubtfully representative nature of the parental series they will not be taken into account in making generalizations from the means of hybrid samples as a whole.

XI. GENERAL CONCLUSIONS REGARDING AVERAGE VALUES OF METRICAL CHARACTERS IN PARENTAL AND DERIVED POPULATIONS

Comparisons of the mean measurements of metrical characters given in the preceding sections possibly suggest that the average for a crossed population always tends to lie between those of the parental populations in cases where the latter themselves differ significantly. A summary and somewhat different treatment of the evidence bearing on this matter may now be considered.

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* Jacob, Lee & Pearson (1903, p. 348) had previously drawn attention to inaccuracies in the data published by Risley, but Mahalanobis (1933, 1934) and Mahalanobis & Bose (1941) have pointed out that their defects were due to misprints, to errors in the calculation of means and in using index tables and to arithmetical slips, all of which can be, and have now been, rectified.

† Standard errors of the Pods were found from the standard deviations given by Guha (1935), and those of the Anglo-Indians from standard deviations calculated from the individual measurements given by Mahalanobis (1922, 1931).

TABLE 15. *Comparison of positions of means between hybrid (H) and non-European (N) and European (E) presumed parental populations**

Nature of comparison	H between N and E	H not between N and E	Totals
No significant differences between N and E	6 or 30·0 %	14 or 70·0 %	20
Significant differences between N and E, but none between either N and H, E and H or both (N and H) and (E and H)	32 or 72·7 %	12 or 27·3 %	44
All differences between N, E and H significant	35 or 97·2 %	1 or 2·8 %	36
All comparisons	73 or 73·0 %	27 or 27·0 %	100

The results relating to a total of 100 comparisons—the figure is fortuitous—of male and female series (excluding that between Pods, Anglo-Indians and English mentioned in the last section) are given in Table 15. These refer to all the available characters for the series treated, with the exception of a few which had to be discarded owing to the fact that there seemed good reason to believe that they had not been measured in comparable ways.†

In Table 15 the position of the mean of the hybrid sample (H) is considered with regard to the significance of the difference between the presumed non-European (N) and European (E) parental groups and its own differences from them. It is clear that the frequency with which the hybrid mean falls between the other two increases as the differences among the mean values of the several series in a triad become more numerous. In the vast majority of cases where the order N, H, E or E, H, N is not observed, this may well be accounted for by errors of random sampling. Among the thirty-six comparisons for which all differences are supposed significant, there is only one showing a departure from the usual order. The single exceptional case pointed out on p. 19 concerns the head breadths of the Maya, Yucatecan and Spanish series. The estimates of the significance of the differences given in Table 8 show that two of them almost certainly indicate that the population means are differentiated, but the third is far less likely to denote the same condition. The mean for the crossed Yucatecan sample is greater than that for the Maya sample, but if in fact the average head breadths for the Maya and Yucatecan populations were identical then a difference between means for samples of the sizes of those available, taken at random, would be expected to exceed the difference of 1·7 mm. observed once in 500 times. It seems to be unwise to lay any stress on a solitary exception to the general rule. The Maya and Yucatecan series were measured independently by different investigators, and it is at least possible that some of their means are not comparable to within 2 mm., because of a difference in technique. Furthermore, it would not be at all surprising if the modern Maya series measured failed to represent the original Maya group involved in the cross in a random fashion. The unusual thing is not that only a single exception should be noted but that the vast majority of the comparisons point to the same general conclusion. The fact that this is so suggests the possibility that the modern series accepted as the best available to represent the presumed parental populations do in fact fulfil such a purpose extraordinarily well. If in a particular case, owing to a changed environment or to other conditions, the type of one parental population did not remain constant between the time when a sample of this population (N) had crossed with a sample of another population (E) to form a third group (H), while the type of the second parental population was unaltered, it is improbable that the observed situation would have been expected to occur with such regularity. If all three groups, N, E and H, were in fact subject to a secular change operating at precisely the same rate, then, from the point of view considered, this would lead to the same result as if they had all been stable. It must, nevertheless, be remembered that a perfectly uniform secular change applying to all the populations concerned would imply that a similar effect was being produced in those subject to a variety of environmental or other conditions. The situation observed thus appears to favour in an indirect way the hypothesis that the averages of the metrical characters considered were generally stable for a particular parental population.

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* In the few cases in which the means of H and N or H and E are identical for a particular character, 0·5 has been assigned to each of the second and third columns of the table.

† The characters in question are ear length, ear breadth and mouth width in the case of the hybrid American Negroes, and ear length, ear breadth, and ear index in the case of the Yucatecans, and facial and nasal index in the case of the Rehoboth Bastaards.

The comparisons in Table 15 on p. 29 have been made without distinction of characters or series, and it might be suggested that information of interest was therefore overlooked. The question whether different characters behave in the same way or not is obviously an important one. It is clear, however, that a more detailed analysis is likely to be profitable only in cases where significant differences are found between the means of the groups compared. There are thirty-six cases in which the differences between the two parental and the hybrid constants are significant, and these will now be more fully considered. Data for them are given in Table 16, and a new criterion designed to measure the position of the hybrid mean relative to the two corresponding parental means may be devised. This is the difference between the hybrid (H) and the European (E) parental value divided by the difference between the non-European (N) and European parental values, i.e. $|H-E|/|N-E|$. Clearly, if H is between E and N a value less than unity will be obtained, and if this value is nearer to zero than unity the hybrid will approach the European mean and if nearer to unity than zero it will approach the non-European mean. Only one value greater than unity is found, the exceptional case already noted in which the Yucatecan mean for head breadth is significantly greater than both the parental values. The data to be considered are of a very meagre kind, since the characters are in general different and of varying numbers for different series. It is evident that 'errors' of random sampling will influence values of the criterion to some extent, even in the case of a particular triad, but this fact is being ignored for the present. The corresponding male and female comparisons for the Norfolk Islanders may be considered first. These show a range from 0·3 to 0·7, and the sexual differences between the constants may well be of no significance. The values for different characters are surprisingly close in the majority of cases, but there is a suggestion that the low values for the cephalic index in the case of both sets, male and female, may not be associated. There is only one other entry for this character in Table 16, viz. in the case of the male Rehoboth Bastaards, and here the value obtained is not low compared with that for other characters. Judging from the very imperfect evidence, it would be unsafe to conclude that there are any consistent differences between the position of the mean for a hybrid group relative to the means of the populations from which it was derived. It would, for example, be quite hazardous to conclude that, in crossing, any particular character, such as the cephalic index, remained closer to the European norm than any other character. The suggestion has often been made that different characters do behave differently in the respect considered, but there appear to be no

TABLE 16. *Estimates of the position of the hybrid (H) mean relative to the presumed non-European (N) and European (E) parental means when all differences between pairs are significant*

Series	Values of |H–E|/|N–E| for different characters			
	Males		Females	
Hybrid American Negroes	Facial height	0·7		
	Nasal breadth	0·6		
Jamaican Browns	Zygomatico-pupillary index	0·7	Mean of six characters	0·6
	Nasal index	0·8		
Half-blood Sioux	Bizygomatic breadth	0·6		
	Nasal breadth	0·4		
Ojibwa-Whites	Bizygomatic breadth	0·6		
	Parieto-zygomatic index	0·5		
Yucatecans	Stature	0·9		
	Head length	0·8		
	Head breadth	1·4		
Rehoboth Bastaards	Stature	0·4		
	Cephalic index	0·5		
Kisar Mestizos	Stature	0·8	Head breadth	0·4
	Head length	0·7		
	Head breadth	0·4		
Norfolk Islanders	Mean of seven characters	0·5	Mean of six characters	0·5

adequate statistical grounds for such a conclusion. A much greater number of well-recorded characters for a single large hybrid series and for two large series relating to the parental populations from which it was actually derived would be of far more value for the quantitative investigation of these matters than all the material bearing on the topic which is at present available. The need is for concentration on a particular instance rather than the accumulation of data of the diffuse and inadequate kind so far collected. In the meanwhile, the best working hypothesis that can be offered is that the group characteristics of all metrical features yield uniform results. It may be noted that the average values of the criteria dealt with in Table 16 may be considered to give estimates of the position of the hybrid relative to the corresponding parental groups. In the case of the Norfolk Islanders, the two means are almost exactly 0·5, a fact which accords remarkably well with the knowledge that these people have equal contributions from non-European and European sources. The figures suggest that most of the other groups stand rather closer to the non-European parental type, and it is not unreasonable to suppose that this confirms the suggestion that the hybrid series in general have a greater degree of non-European than of European ancestry.

XII. THE VARIABILITY AND FORMS OF DISTRIBUTION OF METRICAL CHARACTERS IN HYBRID POPULATIONS

Since the present study is concerned with populations which have resulted from the crossing of different races, it may be asked how variable they are compared with other populations not so formed, or a comparison may be made between the observed situation with regard to this matter and that which would be expected in the light of theoretical considerations. For the moment, only the first of these two methods of procedure, that is to say, the description of the existing situation, will be touched upon. It must be remembered that the topic is treated with reference to measurements of living people, characters of a particular kind which are unlikely to yield any results which might be susceptible of a simple interpretation even under the most favoured conditions. Problems of inheritance are involved, it is true, but specifically those of *mass* inheritance in the case of subjects whose origins are unknown, except within the broadest categories, and in the case of physical features of an extraordinarily complex nature.

The series described, although the best available, are far from ideal when considered as samples representative of a few of the hybrid communities which now exist. In this connexion, it is important to realize that the majority of the samples are assemblages of individuals representing all grades of intermixture between the parental groups. One exception is furnished by the Norfolk Islanders. These may be accepted, roughly at least, as the descendants of a few members of two distinct races who intermarried in the first generation and subsequently inbred so that, with certain reservations, each individual today can claim to possess an equally divided racial heritage. The hybrid American Negroes measured by Herskovits form another exception, since they are subdivided into three series, representing different grades of intermixture between Negroes and Europeans, which are sufficiently large for statistical treatment. In other cases, either no such subgroups are distinguished, or else it is possible to make up large enough samples only by pooling all the individuals of one sex who have been measured.

In these circumstances, it would not be surprising if different hybrid populations showed variabilities of different orders, so that generalizations regarding all of them would not be of much value. As already pointed out, the information regarding the parental groups from which the hybrids have been derived is nearly always inadequate. There are practically no physical records relating to them directly, and for this reason it has been necessary to suppose that data for series presumed to be their descendants can be used for comparative purposes. The assumption that the parental populations have not altered appreciably in type or variability during the past 300 years is not an unreasonable one, but slight changes of which no knowledge exists may nevertheless have taken place.

Another source of uncertainty is likely to be of more consequence. In making comparisons of the mean values of measurements, it has been assumed that only one European stock was concerned in the formation of the hybrid population, which is often no more than a first approximation to the truth. If, however, the same series is used in several comparisons of variability, there will be some danger of underestimating the variabilities of the European groups which actually participated in the cross. It is quite impossible to assess the extent to which the statistics are falsified on account of this. A further difficulty is introduced in cases where the modern hybrid population has been derived from a very few European men on the one side and non-European women on the other (as in that of the Norfolk Islanders), since these small groups may not have displayed the same order of variability as the populations to which they belonged. Small samples are often peculiar, and they are not likely to represent random selections from large assemblies. Finally, it must be admitted that the metrical data themselves involve defects. Different numbers of characters are available for different comparisons of a hybrid with the two corresponding parental series, and this must not be forgotten when comparisons are made between conclusions drawn from one such triad with those drawn from another. In a few instances it is necessary to admit that the same feature may have been measured by two different observers in ways which are sufficiently dissimilar to affect the comparisons of variabilities. It would be easy, of course, to neglect any such imperfections of the evidence when attempting to make general deductions regarding the variability of hybrid populations, but unfortunately they are too obvious to be overlooked.

The observed intergroup variabilities of hybrid populations, as far as these can be judged from the available samples representing them, may now be discussed. A measure is required of the extent to which the individuals composing a particular group differ among themselves, and this has to be obtained in the first place for characters considered singly. In the case of metrical characters, the standard deviation (*s*) is the criterion almost universally used for the purpose today. Professor Eugen Fischer employed it in his study, published in 1913. To account for the fact that it indicated that hybrid variability was often low he later inferred that the measure of dispersion was unsuitable (Fischer, 1930, p. 217). More recently, however, Professor H. J. Muller, an eminent geneticist, has doubted if the term 'variation' applied to biological populations possesses any exact scientific meaning except when defined by the standard deviation or some constant derived from it, such as the variance or the coefficient of variation (Muller, 1936). It should be noted that this opinion might be questioned on statistical grounds if the distributions of metrical characters in hybrid populations were commonly found to be either unimodal and markedly asymmetrical or bimodal in form. It is shown below that the best data available suggest that such distributions are almost invariably described in an adequate way by the symmetrical and unimodal normal curve (any clear departures from this form being quite exceptional), so the use of standard deviations may be accepted without question.*

Those for all the hybrid series and all the series presumed to represent the parental populations used in this study are given in the Appendix. As some of the European parental series have been used in more than one comparison, they are fewer than the non-European parental series, and the number of hybrid series is the largest owing to the fact that data are provided for three subseries of American Negroes of mixed blood and that the *s*'s of some female hybrid series which cannot be compared with those of parental series are also provided.

A glance at the male *s*'s in the Appendix suggests that there are no great differences in variability between hybrid groups in general and the populations from which they were derived. In the case of the cephalic index, for example, both the lowest and the highest *s*'s are found among the hybrids, and there is no character for which the hybrid values are greater than all the parental. For the majority of characters a rough comparison does not even suggest that the hybrid series tend to be more variable than the parental. At the same time there are some, but not many, clearly significant differences between corresponding *s*'s for different hybrid series. It cannot be said that all hybrid populations tend to be equally variable, and, as has been indicated, this is to be expected in view of the different ways in which they have come into being. More exact comparisons can be made, however, and the position looked at from several different points of view.

For example, the method of comparing the variability of different populations in terms of the ratios of their variances devised by Morant (1935) may be used and certain general conclusions reached in it may be considered. It should be pointed out that it is seldom realized that differences between the variabilities of what are presumed to be racially homogeneous populations found in the world to-day are very slight. European groups in general tend to be a little more variable than others, and the populations of small islands where there has been close inbreeding show a peculiarly low degree of variability.

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* Gini (1950) would demur to such a point of view as far as it relates to the distribution of stature, but it is not possible to discuss his arguments in the present study.

Table 17. *Comparison of mean unweighted standard deviations for presumed non-European and European parental and hybrid series**

Character	Males			Females		
	Non-European	Hybrid	European	Non-European	Hybrid	European
Stature	5·79 [7]	6·33 [7]	6·38 [4]	5·06 [3]	5·41 [4]	6·07 [3]
Head length	6·02 [7]	6·72 [7]	6·53 [4]	5·16 [3]	6·11 [3]	5·55 [3]
Head breadth	4·74 [7]	5·08 [7]	5·33 [6]	4·85 [3]	4·89 [4]	4·41 [3]
Bizygomatic breadth	4·96 [6]	5·53 [6]	5·23 [6]	4·72 [3]	4·86 [4]	5·05 [3]
Nasal breadth	2·69 [6]	3·09 [6]	2·67 [4]	2·76 [3]	2·83 [3]	2·48 [3]
Cephalic index	3·08 [8]	3·14 [8]	3·31 [5]	3·10 [4]	2·99 [5]	3·08 [4]
Facial index	4·75 [4]	5·14 [5]	5·85 [5]	4·90 [3]	4·81 [5]	5·11 [4]
Nasal index	7·84 [5]	7·66 [6]	6·83 [5]	7·94 [3]	7·49 [5]	7·12 [4]

The data in Table 17 may be treated first. By computing the mean *s*'s for the European, non-European and hybrid series respectively, the estimates available have rather large sampling errors, and it would be theoretically most correct to obtain such averages from weighted variances. This has not been done because the sample sizes differ so markedly. The mean *s*'s given in Table 17 are all unweighted values, the figure in brackets showing the number of series involved in each case. In considering the two sets of parental populations, it is seen that for the males the European value is in excess of the non-European for all characters except nasal breadth and nasal index, and the same situation occurs in the case of the females except for head breadth, nasal breadth, cephalic index and nasal index. Although the numbers of series involved are restricted, the conclusion that European populations tend to be rather more variable than others often accepted as racially homogeneous is confirmed. In the male constants the average value of the *s* for the hybrid series falls between the values for the two parental series in the case of five characters, and it is the greatest in the case of the remaining three. In the female constants the hybrid average *s* is intermediate for three characters, greatest for three and smallest for two. This is a crude method of comparison, and there would seem to be no point in extending it to the discussion of single characters; but it does at least show that the hybrid series have variabilities which tend to be of almost exactly the same order as those of 'unmixed' populations. At the same time, it has been thought worth while to find the relative variabilities of the three sets of series for all the eight characters in Table 17 considered together by using the method described in Morant's paper to which reference has been made, and the results are given in Table 18. The method in question ascertains the ratio of the variances for each character separately and their averages. These criteria show that the hybrid series as a whole tend to be slightly more variable than the European parental and the latter slightly more variable than the

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* The conditions of comparison are that the mean *s*'s for males should be based on at least four, and those for females on at least three, series, the same characters being available for both sexes. The number of series is shown in brackets after each mean *s*.

TABLE 18. *Comparison of mean ratios of variances for presumed non-European* (*N*) *and European* (*E*) *parental and hybrid* (*H*) *series**

Character	Males						Females					
	E/N	N/E	H/N	N/H	H/E	E/H	E/N	N/E	H/N	N/H	H/E	E/H
Stature	1·21	0·82	1·20	0·84	0·98	1·02	1·44	0·69	1·14	0·87	0·79	1·26
Head length	1·18	0·85	1·25	0·80	1·06	0·94	1·16	0·86	1·40	0·71	1·21	0·83
Head breadth	1·26	0·79	1·15	0·87	0·91	1·10	0·83	1·21	1·02	0·98	1·23	0·81
Bizygomatic breadth	1·11	0·90	1·24	0·80	1·12	0·89	1·14	0·87	1·06	0·94	0·93	1·08
Nasal breadth	0·99	1·02	1·32	0·76	1·34	0·75	0·81	1·24	0·95	0·95	1·30	0·77
Cephalic index	1·15	0·87	1·04	0·96	0·90	1·11	0·99	1·01	0·93	1·07	0·94	1·06
Facial index	1·52	0·66	1·17	0·85	0·77	1·30	1·09	0·92	0·96	1·04	0·89	1·13
Nasal index	0·76	1·32	0·95	1·05	1·26	0·80	0·80	1·24	0·89	1·12	1·11	0·90
Mean ratio of variances	1·15	0·90	1·16	0·87	1·04	0·99	1·03	1·01	1·06	0·96	1·05	0·98

TABLE 19. *Comparison of mean ratios of variances for male American Negroes* (*in separate categories*) *and Old American Whites for twelve characters†*

Horizontal series divided by vertical	N	NNW	NW	NWW	W
N	—	1·28	0·95	1·21	1·01
NNW	0·84	—	0·77	0·91	0·85
NW	1·09	1·36	—	1·25	1·11
NWW	1·00	1·14	0·88	—	1·02
W	1·05	1·34	1·00	1·27	—
Mean ratio of variances	1·00	1·28	0·90	1·16	1·00

non-European parental. A comparison of the results with those provided by Morant in his Table III indicates that the differences in variability between hybrid series in general and non-hybrid series are considerably smaller than those between some non-hybrid series.

The foregoing comparisons of sets of series are obviously not as good as the best possible, and it would certainly be better to compare data for each with those for the corresponding pair of presumed parental populations. This will now be done, considering the case of Herskovits's American Negro groups first as a series representing the different grades of intermixture available for them. Of the three hybrid groups available (see Tables 1 and 2), one, the NWW, is unfortunately represented by only thirty individuals, the other two being fairly adequate in size. The average ratios of the variances in the case of all pairs of the five series and for twelve characters are given in Table 19. The NW series is seen to be the least variable, the wholly Negro together with the wholly White coming next and the NWW followed by the NNW being the most variable. Using a different method of comparison and a larger number of characters, including some in this case for which there are no data for White groups, Herskovits (1930, p. 276) concluded that of the four others the N's were the least variable, followed by the NW's, NWW's and NNW's. The slight discrepancy between these two conclusions is not surprising, since the differences in variability between the NNW and NWW series are in any event very small. The fact that the NW series, which is presumed to be made up of individuals of approximately equal amounts of Negro and White ancestry, should be found to be appreciably less variable than the NNW and the NWW, each of which represents several different grades of hybridization, is not surprising either. It can only be supposed that the majority of other hybrid series represent mixtures of the parental groups in varying proportions so that they are similar to all the three series of hybrid American Negroes. The *s*'s for this pooled series are also included in the Appendix, and for eleven characters they fall between the extreme values of the component groups while for one character, facial height, the pooled series has a smaller *s* than any of the component series. The average ratios for the pooled series compared with the two parental are given in Table 20, and they show that it is slightly more variable than they are. It is difficult to appreciate but an undoubted fact that the pooling of series representing different grades of admixture does not increase variability to an observable extent. The findings are thus in entire agreement with those of Herskovits, who made up a pooled series by combining all the American Negroes of both unmixed and mixed origin that he measured and found that the variabilities for this series were of quite unexceptional orders as compared with those of other populations. Comparisons of the variabilities of a series of extremely mixed origin may thus fail entirely to demonstrate its peculiarity.

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* The conditions of comparison and the number of series are as indicated in Table 17.

† The characters are those shown in Tables 2–4.

TABLE 20. *Comparison of mean ratios of variances for male unmixed* (*N*) *and hybrid* (*H*) *American Negroes and Old American Whites* (*E*)*

Horizontal series divided by vertical	N	H	E
N	—	1·15	1·01
H	0·92	—	0·94
E	1·05	1·21	—
Mean ratio of variances	0·99	1·18	0·98

As has been indicated, the majority of the hybrid series can only be supposed to represent varying grades of intermixture; they are thus similar to the three hybrid series measured by Herskovits combined. Average ratios of the variances of the last and of the other hybrid series in relation to the corresponding European and non-European parental groups considered separately are given in Table 21. In computing these constants, all characters are included for which *s*'s can be given for all the series in a particular triad, and the sets involved in each case can be ascertained from the tables of means in §§ II–X. The data are remarkably uniform in showing no marked differences between the variabilities of the mixed and unmixed series in general. In comparing eight series from different parts of the world, representing populations of the same standing as the parental ones now considered, Morant (1935, p. 307) found the highest ratio to be 1·50 in twenty-eight comparisons, and five values were found to be greater than 1·30. In Table 21 the highest value shown is 1·61, and in the twenty comparisons there are four values greater than 1·30. Hybrid series thus might appear to show a tendency towards exceptional variabilities, but this conclusion is not well established owing to the fact that seven of the series used in the present study form small statistical samples likely to give less reliable comparisons than the long series dealt with by Morant. An examination of the figures reveals some unexpected conclusions. It is found that

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* The characters are those shown in Tables 2–4.

(*a*) the hybrid series is more variable than either corresponding parental series in the case of the hybrid American Negroes, the male and female Jamaican Browns, the half-blood Sioux and the Anglo-Indians, but the difference is marked only in the last case;

(*b*) the hybrid series is less variable than either parental series in the case of the Rehoboth Bastaards and the male and female Norfolk Islanders;

(*c*) in the remaining two cases, the Yucatecans and the Kisar Mestizos, the hybrid series is less variable than the European parental but more variable than the non-European parental group.

TABLE 21. *Mean ratios of variances of hybrid* (*H*) *to presumed non-European* (*N*) *and European* (*E*) *parental series*

Hybrid series	Mean ratios		Number of characters compared
	H/N	H/E	
Male hybrid American Negroes	1·15	1·21	12
Male Jamaican Browns	1·23	1·32	17
Female Jamaican Browns	1·09	1·34	17
Male half-blood Sioux	1·04	1·27	9
Male Yucatecans	1·19	0·87	10
Male Rehoboth Bastaards	0·97	0·84	4
Male Kisar Mestizos	1·17	0·66	4
Male Norfolk Islanders	0·88	0·92	14
Female Norfolk Islanders	0·77	0·82	14
Male Anglo-Indians	1·61	1·55	7

The fact that differences of this kind are to be found is what might have been expected, owing both to the different natures of the hybrid populations considered and to the fact that there is more doubt in some cases than others whether the presumed European samples used can be fairly taken to represent one of the actual parental groups. It should be noticed that the Rehoboth Bastaards and the Norfolk Islanders, who show a peculiarly low variability, are derived from small groups of Europeans who are unlikely to have been as variable as the total populations from which they come. The exceptionally high degree of variability of the Anglo-Indians can well be attributed to the fact that their non-European ancestors constituted a very heterogeneous racial group. Generalization is difficult, but all the evidence concurs in showing that the populations derived from the crossing of distinct racial stocks are not distinguished by a particularly marked degree of variation.

So far comparisons have been made between the variabilities of different series in a generalized way by using the data for a number of characters in conjunction. One objection which may be made to this procedure is that it could obscure clear differences in variability existing in the case of a single character or a small group of characters. It has been shown that the significant differences in averages between any pair of the parental populations (European and non-European) are usually confined to a small proportion of the characters for which comparison is possible. For characters showing insignificant differences it might well be that the hybrid group would not display any increased variability while some increase would be expected in the case of the few characters which clearly differentiate the parental groups. Comparisons of variability will now be made of characters considered singly by treating each associated group of three series, two parental and one derived, in turn.

The problem to be considered is whether there is a relation between divergence of the means of the parental populations and the variability of the hybrid population relative to their variabilities. If there is a clear difference between the averages of the parental groups in the case of a particular character, does it lead to a peculiarly large variation in the derived group or not? The data in Table 22 are compiled with the object of throwing some light on such a question. A difference between the parental means will now be regarded as clearly significant when it exceeds four times its standard error. If two samples were in fact drawn from the same population, their means would differ to a greater extent than this only once in about 16,000 trials. Hence it is safe to suppose that any more significant difference found really does indicate a differentiation of the parental groups.

It will further be supposed that the hybrid series is appreciably more variable than any other with which it is compared if the ratio hybrid/parental of the variances of the characters in question is greater than 1·1, and that the hybrid series is appreciably less variable if the inverse ratio parental/hybrid is greater than 1·1. In point of fact, some of the ratios do exceed this limit, although the differences between the standard deviations are insignificant. Most of the categories in Table 22 relate to characters for which the difference between the parental means is clearly significant, subdivision being made according to whether hybrid variability is appreciably greater than, of the same order as, or appreciably less than the variabilities of the parental series. It is seen that there are very few cases where a marked distinction between the types of the parental groups exists and any definite tendency towards increased variability appears to arise in the derived group as a consequence of such a condition. When all the series are combined, there are eleven entries of this sort. On the other hand, a larger number of entries (sixteen) tends in the opposite direction, viz. that in which the parental means show clearly significant differences but the hybrid series is appreciably less variable than either parental. In thirty-two instances where the parental means are thus differentiated, the hybrid series is not appreciably more or appreciably less variable than either parental. These data lead to the rather surprising conclusion that there is a complete lack of association between the order of variability of different characters in a derived population and the distinction or non-distinction of the average values of the character in the supposed ancestral groups. It should be realized that the criterion used here to distinguish variabilities is in no sense an ideal one from a statistical point of view, as the majority of the s's do not actually differ significantly where the ratio of the variances is greater than 1·1. Among the eleven entries in the second column of Table 22—cases in which the hybrids have been adjudged to be appreciably more variable than either parental series—there are only two where both differences are significant, i.e. $d/e_d \geqslant 2$.

It is quite clear, again, as was shown by the earlier comparisons, that the differences between the variabilities of the hybrid and the parental groups are extremely small. In such circumstances, samples of the sizes available are not sufficient to give any conclusive answer to the kind of question just considered. The situation is entirely obscured owing to the fact that the sampling errors are probably as large as or larger than the quantities of which estimates are required. It is likely that statistically adequate samples would give indications of group tendencies which cannot be estimated from the meagre evidence at present available.

TABLE 22. *Comparison of variabilities of single characters between hybrid and presumed parental series in terms of the order of difference between parental means*

Hybrid series (and number of characters compared)	Clearly significant differences between parental means						All other cases*
	Hybrid series appreciably more variable than either parental series	Hybrid series appreciably more variable than one but not appreciably more or appreciably less variable than the other parental series	Hybrid series not appreciably more or appreciably less variable than either parental series	Hybrid series appreciably more variable than one but appreciably less variable than the other parental series	Hybrid series not appreciably more or appreciably less variable than one but appreciably less variable than the other parental series	Hybrid series appreciably less variable than either parental series	
Male hybrid American Negroes (12)	Stature Nasal breadth	—	—	Facial height	Ear breadth	Ear length	Head length Head breadth Minimum frontal breadth Bizygomatic breadth Nasal height Mouth width Cephalic index
Male Jamaican Browns (17)	Zygomatico-pupillary index Nasal index Ear index	Relative kneeling height	—	Relative sitting height	Relative span	—	Relative arm length Total arm length-upper arm length index Total arm length-forearm length index Brachial index Hand index Parieto-frontal index Foot index Facial index Cephalic index Head length-head height index Head breadth-head height index
Female Jamaican Browns (17)	Relative sitting height Relative span	Relative arm length Relative kneeling height Zygomatico-pupillary index Ear index	Total arm length-upper arm length index	Nasal index	—	—	Total arm length-forearm length index Brachial index Hand index Foot index Cephalic index Head length-head height index Head breadth-head height index Parieto-frontal index Facial index
Male half-blood Sioux (9)	Stature Head length Relative sitting height	Bizygomatic breadth	—	Nasal breadth	—	Physiognomical facial height Cephalic index	Span Head breadth
Male Yucatecans (10)	Head breadth	Nasal breadth Cephalic index	Stature	Head length Ear index	Bigonial breadth	Bizygomatic breadth	Ear length Ear breadth
Male Rehoboth Bastaards (4)	—	—	—	Stature Nasal index	—	Cephalic index	Facial index
Male Kisar Mestizos (4)	—	—	—	Head breadth	Head length	Stature	Cephalic index
Male Norfolk Islanders (14)	—	Bizygomatic breadth	Nasal breadth	—	Head length Zygomatico-frontal index Zygomatico-gonial index	Sitting height Head breadth Minimum frontal breadth Cephalic index Parieto-frontal index	Stature Span Bigonial breadth Parieto-zygomatic index
Female Norfolk Islanders (14)	—	Parieto-frontal index	—	Zygomatico-frontal index	Head breadth Nasal breadth	Span Head length Bizygomatic breadth Cephalic index Zygomatico-gonial index	Stature Sitting height Minimum frontal breadth Bigonial breadth Parieto-zygomatic index

* There are none of these in which the hybrid series is appreciably more variable than either parental series but the difference between the parental means is insignificant.

The general conclusions regarding variability given above accord with those reached by Wagner (1932), who used a different method of comparison except in one particular. Wagner concluded that certain indices expressing the proportions of the arm and the leg indicate a peculiarly high variability for both the Rehoboth Bastaards measured by Fischer and also the Kisar Mestizos measured by Rodenwaldt. These two series are included in the present material, but, where available, the indices were omitted in the case of the Bastaards because no data for them obtained by strictly comparable methods could be found for the hybrid and each parental series, and in that of the Mestizos because the non-European parental series were made up of only fifteen male and nine female subjects. Measurements of the proportions of the trunk and of the limb-segments are notoriously unreliable, and it is often suspected that the high variabilities usually found for them in the case of living series are due to the extreme difficulty of obtaining accurate readings. Data for the brachial index, obtained by expressing the length of the forearm (without the hand) as a percentage of the length of the upper arm, are given in Table 23. The s's of the three male Jamaican series differ insignificantly, and the same is true of the female values for the same groups. All the individuals concerned were measured by a single investigator. There is only one other case, that of the male Rehoboth Bastaards, Hottentots and Dutch, where the brachial index is available for a hybrid and both its presumed parental series, but in this each of the three series was measured by a different person. Alarming divergencies are found among the s's. The difference between those of the parental groups is 2·3 times its standard error, but the s for male Bastaards is more than twice as large as either of the corresponding parental values, and it differs very significantly from every other s in the table, except the female constant for the same series. The Kisar Mestizos exhibit a low variability of the brachial index. When all the data for living series are considered together, more significant differences are found between different s's for this than for the other characters that have been taken into account, but even here there is not the slightest suggestion that hybrid populations are more variable than unmixed ones except in the case of the Rehoboth Bastaards. At the bottom of the table, the ranges of the s's for five male series of skeletons—an Anglo-Saxon, a medieval Swiss, a modern French, a modern Lapp and a modern Chinese—and four female series—the same, excluding the Chinese—are given (Münter, 1936). The values are all lower than any for the living series and very decidedly lower in the majority of cases. The lengths of the upper arm and forearm and of the disarticulated humerus and radius, respectively, are almost identical measurements, and if all could be taken with the same degree of accuracy there appears to be no reason why the index for the living should show greater variability than that for the skeleton. Yet very appreciable differences occur between the constants of the two, and this is almost certainly due to the fact that large 'errors' are involved in taking the measurements on living subjects. Such comparisons usually suggest that estimates of bodily proportions for the living are highly unreliable when compared with those derived from the skeleton. The data in Table 23 can be taken as an example of this commonly observed fact, but it may still be suggested that the s's of the Rehoboth Bastaards are so outstandingly high that there must have been abnormal variation which could not be attributed entirely to the unreliability of the measurements involved.

On such an hypothesis it would be necessary to conclude that a particular hybrid series showed an astonishingly increased variability for the character in question while not even a tendency in the same direction was observed in any similar group. No inconsistency of this sort has been noted for any other character, and in general there is a remarkable concordance between the conclusions derived from samples of different hybrid populations. A scrutiny of the individual readings of the brachial index for the Bastaards indicates enormous ranges of variation, from 61 to 111 in the case of the males and from 67 to 108 in that of the females. The difference between the appearance of one subject whose forearm was little more than half the length of his upper arm and that of another whose forearm was appreciably longer than his upper arm would surely be noted by an observant person who had had no training in anthropology.* Nothing whatever about this surprising peculiarity of the subjects examined is said in the detailed report. The variability of the Rehoboth Bastaard series in general is discussed by Fischer for a selected group of characters, and he comments on the fact that it is not especially large, but the indices involving the lengths of the upper arm and forearm are omitted for no obvious reason and they, in fact, vary to an abnormally high degree. This seems a curious oversight unless the author appreciated that the measurements in question were unreliable. The range of the brachial index in the seventy-three male Hottentots measured by Schultze is only from 76 to 93. Without confirmation of the anomalous measurements given for the Rehoboth Bastaards, there seems to be sufficient justification for supposing that gross errors were made either in recording the values or in reducing them.

TABLE 23. *Standard deviations of brachial indices in hybrid and presumed parental series compared with standard deviations of humero-radial indices in series of skeletons*†

Index	Non-European parental series	Hybrid series	European parental series
Brachial, i.e. 100 forearm/upper arm	Male Jamaican Blacks 5·66 ± 0·54 (54)	Male Jamaican Browns 5·74 ± 0·42 (93)	Male Jamaican Whites 7·42 ± 0·76 (48)
	Female Jamaican Blacks 5·72 ± 0·57 (50)	Female Jamaican Browns 6·17 ± 0·51 (72)	Female Jamaican Whites 5·00 ± 0·51 (49)
	Male Mayas 3·88 ± 0·39 (50)		
	Female Mayas 4·72 ± 0·49 (47)		
	Male Hottentots 3·47 ± 0·29 (73)	Male Rehoboth Bastaards 11·15 ± 0·96 (67)	Male Dutch 4·88 ± 0·55 (39)
		Female Rehoboth Bastaards 10·40 ± 0·87 (72)	Female Dutch 4·52 ± 0·56 (33)
		Male Kisar Mestizos 4·22 ± 0·34 (77)	
		Female Kisar Mestizos 4·35 ± 0·44 (48)	
Humero-radial, i.e. 100 radius/humerus	Range of five male series 1·82 ± 0·19–2·62 ± 0·23 (45–216) Range of four female series 1·62 ± 0·22–3·23 ± 0·37 (26–179)		

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* It is impossible to check the calculation of the brachial indices of the Rehoboth Bastaards because the component lengths are not given in Fischer's text and, since the original records no longer exist (see p. 19, note †), there is no means of determining what they were. It may be noted that the forearm-hand index also shows a male range from 38 to 95 and a female from 51 to 92, although the ranges for other indices that express bodily proportions do not appear to be in any way outstanding.

† The ranges of the *s*'s for the humero-radial indices are taken from Münter (1936), and the sample sizes are shown in parentheses.

On the whole it is safe to conclude that most measurements of bodily proportions found in the literature are not sufficiently reliable to provide valid comparisons of hybrid with other populations, and in particular it is unsafe to conclude that the variabilities for them would yield any different general conclusions from those based on head measurements. The fact that no appreciable difference exists between the variabilities of hybrid and unmixed groups is certainly unexpected, but the best evidence available shows in a convincing manner, that, while some of them have a tendency towards peculiarly great, others have a tendency towards peculiarly small, variability. These deviations are never marked enough, however, to indicate in themselves that the groups had peculiar origins.* So far the observed situation has been considered and several interpretations of it might be thought plausible. It is possible that, for hybrid populations in general, the exceptionally high variability which might have been anticipated is counteracted by closer inbreeding than is usual for populations having less diversity in their racial origins. As far as can be judged, the results obtained lend support to such a view. The Norfolk Islanders who are known to be closely inbred show an exceptionally small variability, but the hybrid American Negroes and the Anglo-Indians are rather more variable than the groups representing the parental populations from which they are presumed to have been derived. It is seldom possible to obtain any exact measure of the degree of inbreeding to which different hybrid populations have been subjected, but as there was certainly diversity in this respect, the differences observed among the various groups are not at all surprising.

It has often been assumed that the forms of distribution of certain metrical characters in hybrid populations would have peculiarities which indicated their diverse origins. In the case of a particular hybrid group derived from two more or less homogeneous groups, bimodality would be expected only in the case of those characters which made a clear distinction between the parental populations. In anthropological practice, the occurrence of a distribution which can be taken to indicate that the character in the population from which the sample was taken showed any clear departure from the usual symmetrical or unimodal form is apparently never met with (Morant, 1939).† Some of the distributions for the hybrid series considered here may be supposed as likely to show unusual forms as any that might be considered by the anthropologist. The question is treated by fitting normal curves to the distributions of certain characters and estimating the probability that the total population represented conforms to the theoretical type by applying the χ^2 test. The results obtained are given in Table 24.

Six characters were selected for the purpose, and it has been seen that in a good many cases the means for them make a clear distinction between the corresponding parental groups. This is particularly so as far as the bizygomatic breadth and the nasal index are concerned. All distributions are made up of more than seventy-five individuals, and any number under a hundred must be considered decidedly small for the purpose. The P values given lead to the rather surprising conclusion that the hypothesis that the character was normally distributed in the population represented is not entirely unacceptable in a single instance. The lowest value of P is 0·046, indicating that for samples of the same size drawn at random one in twenty-two would be expected to show a worse fit than that actually found. The fact that the vast majority of the values of P are high does not prove that the distributions of these metrical characters in hybrid groups are all precisely of the normal form, but it is good evidence of the fact that none of them shows any clear departure from the symmetrical and unimodal type. Samples of much larger sizes would be required to provide any detailed knowledge of the forms of the distributions in the populations from which the samples have been taken. In discussing this matter, anthropologists have often ignored the fact that the samples they use are really only of interest in so far as they give information regarding the *populations* represented. No importance should be attributed to the fact that particular distributions show marked asymmetry or more than one peak unless it can be shown that these peculiarities are also attributes of the population represented. Small samples, made up of fewer than a hundred individuals each, say, are of little value in examining this question, and it is almost invariably found that peculiarities which at first sight appear to be of anthropological significance are less clear or wanting entirely in the case of adequately large samples. It can be stated categorically that the material available does not suggest that the distributions of metrical characters in populations derived from the crossing of distinct racial groups are in any way peculiar when compared with those in populations of unmixed origin. The data for longer series might show that they have some distinctive features, but so far there is no suggestion of this.

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* Keen (1951) has confirmed this finding in a craniometric study of the Cape Coloured population, whose racial make-up must be one of the most involved to be found anywhere in the world.

† See, however, p. 33, note *.

TABLE 24. *Values of P for hybrid series**

Hybrid series	Characters					
	Stature	Head length	Head breadth	Bizygomatic breadth	Cephalic index	Nasal index
Male hybrid American Negroes	0·758 (225) [12]	0·764 (254) [12]	0·046 (254) [11]	0·502 (254) [9]	0·755 (254) [9]	—
Male Jamaican Browns	—	—	—	—	0·140 (93) [7]	0·831 (80) [8]
Male half-blood Sioux	0·133 (77) [12]	0·664 (77) [12]	0·833 (77) [8]	0·330 (76) [9]	0·297 (77) [9]	— —
Male Ojibwa-Whites	—	—	0·146 (80) [8]	0·199 (80) [7]	—	—
Female Ojibwa-Whites	—	—	0·049 (86) [6]	0·459 (86) [8]	—	—
Female Rehoboth Bastaards	0·150 (84) [8]	—	—	—	0·843 (90) [12]	0·247 (88) [6]
Male Kisar Mestizos	0·532 (79) [6]	—	—	—	0·424 (80) [7]	0·145 (78) [6]
Male Anglo-Indians	0·455 (145) [9]	0·075 (145) [10]	0·365 (145) [15]	— —	0·651 (145) [14]	0·237 (145) [14]

* The figures in parentheses denote the size of a sample and those in brackets the number of groups used in the χ^2 test.

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APPENDIX. *Standard deviations of presumed non-European and European parental series and hybrids*

Series	Stature	Head length	Head breadth	Minimum frontal breadth	Bizygomatic breadth	Facial height	Nasal height	Nasal breadth	Ear length	Ear breadth	Cephalic index	Parieto-frontal index	Parieto-zygomatic index	Facial index	Nasal index	Ear inde
Male American Negroes (N)[a]	5·65 ± 0·39 (102)	6·54 ± 0·65 (109)	5·23 ± 0·35 (109)	4·19 ± 0·29 (108)	5·40 ± 0·37 (108)	5·59 ± 0·38 (108)	3·16 ± 0·21 (109)	2·81 ± 0·19 (109)	4·57 ± 0·31 (108)	3·21 ± 0·22 (108)	3·22 ± 0·22 (109)	—	—	—	—	—
Male Jamaican Blacks[b]	—	—	—	—	—	—	—	—	—	—	2·76 ± 0·27 (54)	4·67 ± 0·45 (54)	—	5·53 ± 0·53 (54)	9·20 ± 0·89 (42)	3·69 ± 0·36 (54)
Male Sioux[c]	5·44 ± 0·17 (537)	6·16 ± 0·19 (539)	5·39 ± 0·16 (539)	—	5·45 ± 0·17 (538)	—	—	3·22 ± 0·01 (540)	—	—	3·20 ± 0·10 (537)	—	—	—	—	—
Male Ojibwa	—	—	3·93 ± 0·57 (24)	—	3·64 ± 0·53 (24)	—	—	—	—	—	—	—	1·96 ± 0·28 (24)	—	—	—
Male Mayas[d]	5·25 ± 0·42 (77)	5·33 ± 0·43 (77)	4·95 ± 0·40 (77)	—	5·14 ± 0·51 (50)	6·58 ± 0·66 (50)	—	2·51 ± 0·25 (50)	3·73 ± 0·37 (50)	2·56 ± 0·26 (50)	2·80 ± 0·23 (77)	—	—	3·90 ± 0·39 (50)	5·95 ± 0·59 (50)	3·24 ± 0·32 (50)
Male Hottentots	6·47 ± 0·54 (73)	5·41 ± 0·44 (74)	3·89 ± 0·32 (74)	—	4·14 ± 0·34 (74)	—	—	2·34 ± 0·19 (74)	—	—	2·62 ± 0·22 (74)	—	—	5·08 ± 0·42 (74)	0·96 ± 0·82 (74)	—
Male Kisarese	6·43 ± 0·73 (39)	5·84 ± 0·66 (39)	3·78 ± 0·43 (39)	—	—	—	—	—	—	—	2·81 ± 0·29 (47)	—	—	—	—	—
Male Society Islanders[e]	5·91 ± 0·45 (85)	6·54 ± 0·50 (85)	4·96 ± 0·38 (85)	4·99 ± 0·38 (85)	5·13 ± 0·39 (85)	6·35 ± 0·49 (85)	—	2·77 ± 0·21 (85)	—	—	3·84 ± 0·29 (85)	3·02 ± 0·23 (85)	2·65 ± 0·20 (85)	4·48 ± 0·34 (85)	7·22 ± 0·55 (85)	—
Male North Indians	5·38 (c. 3500)	6·30 (c. 3500)	5·00 (c. 3500)	—	4·50 (c. 3500)	—	2·88 (c. 3500)	2·51 (c. 3500)	—	—	3·36 (c. 3500)	—	—	—	6·86 (c. 3500)	—
Male American Negroes (NNW)[f]	6·77 ± 0·45 (115)	7·06 ± 0·44 (129)	6·44 ± 0·40 (129)	5·15 ± 0·32 (129)	6·87 ± 0·43 (129)	6·20 ± 0·59 (127)	3·71 ± 0·23 (129)	3·44 ± 0·21 (129)	4·00 ± 0·25 (129)	2·58 ± 0·16 (129)	3·77 ± 0·23 (129)	—	—	—	—	—
Male American Negroes (NW)[g]	5·93 ± 0·45 (87)	6·40 ± 0·46 (95)	4·78 ± 0·35 (95)	4·26 ± 0·31 (94)	6·00 ± 0·44 (95)	6·03 ± 0·44 (95)	3·24 ± 0·24 (95)	3·01 ± 0·22 (95)	3·79 ± 0·28 (94)	2·67 ± 0·19 (95)	2·88 ± 0·21 (95)	—	—	—	—	—
Male American Negroes (NWW)[h]	7·05 ± 1·04 (23)	6·98 ± 0·90 (30)	6·76 ± 0·87 (30)	4·40 ± 0·57 (30)	7·18 ± 0·93 (30)	5·93 ± 0·77 (30)	3·45 ± 0·45 (30)	3·86 ± 0·50 (30)	3·45 ± 0·45 (30)	2·06 ± 0·27 (30)	3·58 ± 0·46 (30)	—	—	—	—	—
Male American Negroes (NNW + NW + NWW)[i]	6·48 ± 0·31 (225)	6·84 ± 0·30 (254)	5·88 ± 0·26 (254)	4·75 ± 0·21 (235)	6·44 ± 0·29 (254)	5·92 ± 0·26 (252)	3·49 ± 0·15 (254)	3·55 ± 0·16 (254)	3·88 ± 0·17 (253)	2·55 ± 0·11 (254)	3·47 ± 0·15 (254)	—	—	—	—	—
Male Jamaican Browns[k]	—	—	—	—	—	—	—	—	—	—	2·80 ± 0·21 (93)	4·47 ± 0·33 (92)	—	5·20 ± 0·38 (93)	9·81 ± 0·78 (80)	6·17 ± 0·45 (92)
Male half-blood Sioux[l]	6·81 ± 0·55 (77)	7·12 ± 0·57 (77)	5·04 ± 0·41 (77)	—	5·49 ± 0·45 (76)	—	—	3·04 ± 0·24 (77)	—	—	2·64 ± 0·21 (77)	—	—	—	—	—
Male Ojibwa-Whites	—	—	4·68 ± 0·37 (80)	—	6·05 ± 0·48 (80)	—	—	—	—	—	—	—	2·89 ± 0·23 (80)	—	—	—
Male Yucatecans[m]	5·40 ± 0·13 (865)	5·94 ± 0·14 (880)	5·35 ± 0·13 (880)	—	4·88 ± 0·12 (880)	—	—	3·05 ± 0·07 (880)	3·94 ± 0·10 (706)	2·53 ± 0·07 (706)	3·22 ± 0·08 (880)	—	—	4·68 ± 0·11 (879)	6·28 ± 0·15 (880)	4·15 ± 0·11 (706)
Male Rehoboth Bastaards	6·58 ± 0·59 (69)	—	—	—	—	—	—	—	—	—	2·45 ± 0·20 (74)	—	—	5·57 ± 0·46 (74)	8·27 ± 0·68 (73)	—
Male Kisar Mestizos	5·86 ± 0·47 (79)	6·10 ± 0·44 (79)	4·26 ± 0·34 (79)	—	5·04 ± 0·41 (77)	—	—	3·14 ± 0·25 (79)	—	—	3·44 ± 0·27 (79)	—	—	5·08 ± 0·40 (79)	7·33 ± 0·59 (76)	—
Male Norfolk Islanders[n]	6·35 ± 0·56 (64)	5·82 ± 0·51 (64)	4·34 ± 0·38 (64)	4·38 ± 0·39 (64)	5·25 ± 0·46 (64)	—	—	2·79 ± 0·25 (64)	—	—	2·86 ± 0·25 (64)	2·85 ± 0·25 (64)	2·81 ± 0·25 (64)	5·17 ± 0·46 (64)	6·14 ± 0·54 (64)	—
Male Anglo-Indians	6·45 ± 0·38 (145)	8·49 ± 0·50 (145)	5·98 ± 0·35 (145)	—	—	—	4·22 ± 0·25 (145)	3·00 ± 0·18 (145)	—	—	4·26 ± 0·25 (145)	—	—	—	8·15 ± 0·48 (145)	—
Male Old Americans[o]	5·80 ± 0·15 (727)	6·04 ± 0·16 (727)	5·20 ± 0·14 (727)	4·24 ± 0·19 (247)	4·82 ± 0·22 (247)	6·72 ± 0·30 (247)	3·36 ± 0·15 (247)	2·51 ± 0·11 (247)	5·72 ± 0·26 (247)	2·52 ± 0·11 (247)	3·01 ± 0·14 (727)	—	—	5·00 ± 0·22 (247)	6·05 ± 0·27 (247)	—
Male Jamaican Whites[p]	—	—	—	—	—	—	—	—	—	—	3·42 ± 0·34 (50)	2·62 ± 0·26 (49)	—	6·33 ± 0·64 (49)	5·97 ± 0·66 (44)	5·25 ± 0·53 (50)
Male Minnesota French	—	—	5·58 ± 0·39 (100)	—	5·42 ± 0·38 (100)	—	—	—	—	—	—	—	3·07 ± 0·22 (100)	—	—	—
Male Minnesota Scots	—	—	5·12 ± 0·51 (50)	—	5·65 ± 0·56 (50)	—	—	—	—	—	—	—	2·84 ± 0·28 (50)	—	—	—
Male Spanish[q]	5·70 ± 0·11 (416)	7·56 ± 0·60 (79)	4·72 ± 0·38 (79)	—	5·80 ± 0·46 (78)	—	—	3·08 ± 0·25 (79)	3·96 ± 0·32 (79)	3·04 ± 0·24 (79)	3·23 ± 0·26 (79)	—	—	7·12 ± 0·57 (77)	7·68 ± 0·61 (79)	4·94 ± 0·39 (79)
Male Dutch	7·24 ± 0·61 (70)	6·96 ± 0·59 (70)	6·68 ± 0·56 (70)	—	5·08 ± 0·49 (54)	—	—	2·37 ± 0·26 (41)	—	—	3·85 ± 0·33 (70)	—	—	6·00 ± 0·66 (41)	7·55 ± 0·84 (40)	—
Male English[r]	6·76 ± 0·06 (5426)	5·56 ± 0·47 (71)	4·67 ± 0·39 (71)	4·91 ± 0·41 (71)	4·60 ± 0·39 (71)	6·67 ± 0·56 (70)	3·66 ± 0·31 (71)	2·71 ± 0·23 (71)	—	—	3·02 ± 0·25 (71)	3·15 ± 0·26 (71)	2·91 ± 0·24 (71)	4·78 ± 0·40 (70)	6·88 ± 0·58 (71)	—
Female Jamaican Blacks[s]	—	—	—	—	—	—	—	—	—	—	3·05 ± 0·30 (51)	3·87 ± 0·39 (50)	—	5·42 ± 0·54 (50)	10·25 ± 1·32 (30)	5·85 ± 0·58 (51)
Female Sioux	5·29 ± 0·30 (157)	5·09 ± 0·29 (156)	4·83 ± 0·27 (157)	—	5·05 ± 0·28 (157)	—	—	2·91 ± 0·16 (157)	—	—	2·68 ± 0·15 (156)	—	—	—	—	—
Female Mayas[t]	4·68 ± 0·44 (56)	4·08 ± 0·39 (56)	4·26 ± 0·41 (55)	—	4·16 ± 0·41 (51)	—	—	2·06 ± 0·20 (51)	—	—	2·84 ± 0·27 (56)	—	—	4·28 ± 0·44 (48)	5·65 ± 0·58 (48)	—
Female Kisarese	5·01 ± 0·71 (25)	5·39 ± 0·76 (25)	5·36 ± 0·76 (25)	—	—	—	—	—	—	—	3·35 ± 0·47 (25)	—	—	—	—	—
Female Society Islanders[u]	5·21 ± 0·45 (68)	6·31 ± 0·54 (68)	5·46 ± 0·47 (68)	4·32 ± 0·37 (67)	4·96 ± 0·43 (68)	—	—	3·31 ± 0·28 (68)	—	—	3·82 ± 0·33 (68)	2·78 ± 0·24 (67)	3·05 ± 0·26 (68)	5·00 ± 0·43 (68)	7·91 ± 0·68 (68)	—
Female Jamaican Browns[w]	—	—	—	—	—	—	—	—	—	—	3·46 ± 0·29 (72)	3·87 ± 0·32 (72)	—	4·96 ± 0·42 (71)	8·16 ± 0·81 (51)	5·92 ± 0·49 (72)
Female Ojibwa-Whites	—	—	5·34 ± 0·41 (86)	—	5·47 ± 0·42 (86)	—	—	—	—	—	—	—	2·91 ± 0·22 (86)	—	—	—
Female Yucatecans	5·20 ± 0·14 (687)	6·02 ± 0·16 (694)	4·94 ± 0·13 (694)	—	4·86 ± 0·13 (694)	—	—	2·96 ± 0·08 (694)	—	—	3·28 ± 0·09 (694)	—	—	4·60 ± 0·12 (694)	6·12 ± 0·16 (694)	—
Female Rehoboth Bastaards	5·88 ± 0·45 (84)	—	—	—	—	—	—	—	—	—	2·36 ± 0·18 (90)	—	—	4·66 ± 0·35 (89)	10·33 ± 0·78 (88)	—
Female Kisar Mestizos	5·50 ± 0·53 (53)	6·92 ± 0·66 (55)	4·44 ± 0·42 (55)	—	4·40 ± 0·42 (55)	—	—	2·80 ± 0·27 (53)	—	—	3·26 ± 0·31 (55)	—	—	4·80 ± 0·47 (53)	7·05 ± 0·68 (53)	—
Female Norfolk Islanders[x]	5·04 ± 0·50 (49)	5·39 ± 0·54 (49)	4·84 ± 0·49 (49)	4·61 ± 0·47 (49)	4·72 ± 0·48 (49)	—	—	2·74 ± 0·28 (49)	—	—	2·61 ± 0·26 (49)	3·15 ± 0·32 (49)	2·40 ± 0·24 (49)	5·01 ± 0·51 (49)	5·77 ± 0·58 (49)	—
Female Old Americans	5·79 ± 0·28 (211)	5·54 ± 0·27 (210)	4·54 ± 0·22 (210)	—	4·79 ± 0·23 (210)	—	—	2·09 ± 0·10 (209)	—	—	2·91 ± 0·14 (210)	—	—	4·35 ± 0·21 (210)	5·88 ± 0·14 (210)	—
Female Jamaican Whites[y]	—	—	—	—	—	—	—	—	—	—	3·87 ± 0·39 (50)	2·76 ± 0·28 (49)	—	5·34 ± 0·53 (50)	7·15 ± 0·71 (50)	5·10 ± 0·51 (50)
Female Dutch	6·10 ± 0·56 (60)	4·51 ± 0·42 (59)	4·07 ± 0·37 (60)	—	4·82 ± 0·56 (43)	—	—	2·61 ± 0·33 (32)	—	—	2·66 ± 0·24 (59)	—	—	5·00 ± 0·62 (33)	7·10 ± 0·87 (33)	—
Female English[z]	6·33 ± 0·12 (1498)	6·59 ± 0·26 (310)	4·63 ± 0·19 (310)	4·12 ± 0·17 (306)	5·55 ± 0·22 (307)	—	—	2·75 ± 0·11 (307)	—	—	2·86 ± 0·11 (310)	3·05 ± 0·12 (306)	3·41 ± 0·14 (307)	—	—	—

[a] Also mouth width 3·77 ± 0·26 (107).

[b] Also relative sitting height 1·57 ± 0·15 (54), relative kneeling height 0·88 ± 0·08 (54), relative span 2·79 ± 0·27 (53), relative arm length 1·13 ± 0·11 (54), total arm length-upper arm length index 1·18 ± 0·11 (54), total arm length-forearm length index 1·49 ± 0·14 (54), brachial index 5·66 ± 0·54 (54), hand index 2·46 ± 0·24 (53), foot index 2·01 ± 0·20 (53), head length-head height index 2·89 ± 0·28 (53), head breadth-head height index 3·42 ± 0·33 (53) and zygomatico-pupillary index 1·81 ± 0·18 (53).

[c] Also span 7·03 ± 0·21 (535), physiognomical facial height 8·32 ± 0·32 (330) and relative sitting height 1·68 ± 0·05 (536).

[d] Also bigonial breadth 5·54 ± 0·55 (50).

[e] Also sitting height 3·43 ± 0·26 (85), span 7·36 ± 0·57 (84), bigonial breadth 6·11 ± 0·47 (85), zygomatico-frontal index 3·30 ± 0·25 (85) and zygomatico-gonial index 4·19 ± 0·32 (85).

[f] Also mouth width 4·23 ± 0·27 (126).

[g] Also mouth width 3·21 ± 0·23 (95).

[h] Also mouth width 3·46 ± 0·45 (30).

[i] Also mouth width 3·81 ± 0·17 (251).

[k] Also relative sitting height 1·43 ± 0·10 (93), relative kneeling height 0·84 ± 0·06 (93), relative span 2·85 ± 0·21 (93), relative arm length 1·10 ± 0·08 (91), total arm length-upper arm length index 1·62 ± 0·12 (88), total arm length-forearm length index 1·72 ± 0·13 (88), brachial index 5·74 ± 0·42 (93), hand index 2·89 ± 0·22 (89), foot index 2·02 ± 0·15 (89), head length-head height index 2·74 ± 0·20 (93), head breadth-head height index 3·39 ± 0·25 (93) and zygomatico-pupillary index 2·53 ± 0·19 (93).

[l] Also span 6·99 ± 0·57 (76), physiognomical facial height 7·27 ± 0·89 (55) and relative sitting height 1·94 ± 0·16 (77).

[m] Also bigonial breadth 5·47 ± 0·13 (878).

[n] Also sitting height 3·15 ± 0·28 (64), span 7·41 ± 0·67 (62), bigonial breadth 4·66 ± 0·41 (64), zygomatico-frontal index 3·22 ± 0·28 (64) and zygomatico-gonial index 3·74 ± 0·33 (64).

[o] Also span 7·41 ± 0·33 (245), physiognomical facial height 8·91 ± 0·52 (147), mouth width 3·78 ± 0·17 (247) and relative sitting height 1·20 ± 0·05 (247).

[p] Also relative sitting height 1·27 ± 0·13 (50), relative kneeling height 0·53 ± 0·05 (50), relative span 3·28 ± 0·33 (50), relative arm length 1·17 ± 0·12 (50), total arm length-upper arm length index 1·72 ± 0·18 (47), total arm length-forearm length index 1·66 ± 0·17 (47), brachial index 7·42 ± 0·76 (48), hand index 2·60 ± 0·26 (49), foot index 2·07 ± 0·21 (48), head length-head height index 3·63 ± 0·37 (49), head breadth-head height index 2·80 ± 0·28 (50) and zygomatico-pupillary index 3·71 ± 0·31 (71).

[q] Also bigonial breadth 5·96 ± 0·48 (78).

[r] Also sitting height 3·36 ± 0·03 (5416), span 7·67 ± 0·07 (5415), bigonial breadth 5·27 ± 0·44 (71), zygomatico-frontal index 3·71 ± 0·31 (71) and zygomatico-gonial index 3·84 ± 0·32 (71).

[s] Also relative sitting height 1·27 ± 0·13 (51), relative kneeling height 0·66 ± 0·07 (50), relative span 2·34 ± 0·23 (51), relative arm length 1·22 ± 0·12 (49), total arm length-upper arm length index 1·40 ± 0·14 (49), total arm length-forearm length index 1·51 ± 0·15 (49), brachial index 5·72 ± 0·57 (50), hand index 2·86 ± 0·29 (50), foot index 2·47 ± 0·26 (44), head length-head height index 3·01 ± 0·30 (49), head breadth-head height index 3·71 ± 0·37 (49) and zygomatico-pupillary index 2·32 ± 0·23 (51).

[t] Also relative sitting height 0·98 ± 0·10 (48).

[u] Also sitting height 4·86 ± 0·42 (68), span 6·18 ± 0·54 (65), bigonial breadth 6·83 ± 0·59 (68), zygomatico-frontal index 3·32 ± 0·29 (67) and zygomatico-gonial index 4·81 ± 0·41 (68).

[w] Also relative sitting height 1·64 ± 0·14 (72), relative kneeling height 0·87 ± 0·07 (72), relative span 3·11 ± 0·26 (72), relative arm length 1·20 ± 0·10 (68), total arm length-upper arm length index 1·34 ± 0·11 (71), total arm length-forearm length index 1·45 ± 0·12 (71), brachial index 6·17 ± 0·51 (72), hand index 2·72 ± 0·23 (71), foot index 2·05 ± 0·23 (39), head length-head height index 3·12 ± 0·27 (68), head breadth-head height index 3·61 ± 0·31 (68) and zygomatico-pupillary index 2·38 ± 0·20 (72).

[x] Also sitting height 3·41 ± 0·35 (47), span 5·87 ± 0·60 (48), bigonial breadth 4·20 ± 0·42 (49), zygomatico-frontal index 3·54 ± 0·36 (49) and zygomatico-gonial index 2·81 ± 0·28 (49).

[y] Also relative sitting height 1·22 ± 0·12 (50), relative span 2·17 ± 0·22 (50), relative kneeling height 0·89 ± 0·09 (50), relative arm length 0·95 ± 0·10 (49), total arm length-upper arm length index 1·28 ± 0·14 (44), total arm length-forearm length index 1·39 ± 0·15 (45), brachial index 5·00 ± 0·51 (49), hand index 2·59 ± 0·27 (46), foot index 2·22 ± 0·24 (44), head length-head height index 3·46 ± 0·35 (50), head breadth-head height index 3·20 ± 0·32 (50) and zygomatico-pupillary index 1·53 ± 0·15 (50).

[z] Also sitting height 3·41 ± 0·12 (1498), span 7·30 ± 0·13 (1549), bigonial breadth 5·61 ± 0·23 (307), zygomatico-frontal index 3·76 ± 0·15 (304) and zygomatico-gonial index 3·58 ± 0·14 (305).

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